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NON-SYNCHRONOUS GENERATOR STATION.

In our issue of April 11, 1908, Mr. M. Yazidjian, in discussing an A. I. E. E. paper by Mr. W. L. Waters, abstracted in our issue for February 22, called attention to an electrical transmission system in Switzerland employing non-synchronous generators in two of its three hydro-electric stations. In our present issue Mr. Yazidjian gives a complete description of this interesting installation, together with an outline of the results obtained during the two years that the system has been in operation. Since a non-synchronous generator is merely an induction motor subjected to a negative load, in comparison with the alternator of the usual type, it possesses the advantages of the induction motor over the synchronous motor in being extremely simple and necessitating almost no attention, while it is relatively disadvantageous in requiring a separate source of exciting current. In the case described in this issue, the non-synchronous generators in two stations receive current for excitation from synchronous generators in a third station, the former machines acting as though they were induction motors with reference to the lagging wattless current taken by them, and performing the function of generators with reference to the power component of current delivered by them to the system.

It is instructive to investigate the division of load between synchronous and non-synchronous generators operating in parallel. When two synchronous generators are connected in parallel, the division of load is determined wholly by the load-speed characteristic of the two prime-movers. If a non-synchronous generator were substituted for one of the above generators, all other conditions remaining the same, the division of load would be greatly altered, the change depending largely upon the value of the resistance of the secondary winding of the non-synchronous machine; in any event, the synchronous generator would carry a larger portion of the load than under former conditions. Assume now, for example, that a synchronous generator driven by a prime mover having a four per cent drop in speed from no-load to full-load is connected in parallel with a non-synchronous generator requiring a two per cent negative "slip" from no-load to full-load and driven by a prime mover having a two per cent drop in speed from no-load to full-load; these two generators will divide the load in the ratio of their relative ratings quite independently of the difference in their types. That is to say, for correct division of load it is essential merely that the speed "regulation" of the prime mover of the synchronous generator be equal to the sum of the speed "regulations" of the non-synchronous machine and its prime mover.

It would seem therefore that although the statement made by Mr. Yazidjian as to the power furnished by the non-synchronous generators being constant while all of the fluctuations are carried by the synchronous machines, may be applicable to the system described by him, this statement should not be

taken as indicating the impossibility of causing these two types of generators to divide the load properly under all conditions of service. For simplicity in equipment and in operation it was considered desirable to place all of the regulating apparatus in the synchronous generator station, and to adjust the turbine of the non-synchronous machines to consume a constant amount of water and thereby to deliver almost a constant amount of power to the system. The equipment installed possesses the minimum of complication, and one can easily believe that it had given satisfaction in operation. The conditions under which it is desirable to employ non-synchronous generators are somewhat unusual, but their characteristic and advantageous features for certain duties should not be ignored.

Central Station Accounting.

Communications in relation to the suggested scheme of accounts for electric lighting properties in New York State, published elsewhere in this issue, present the point of view of both large and small companies. The corporation that operates in a large city would necessarily use a classification of operating accounts that shows its revenues and expenses in much greater detail than the small concern that serves only a few consumers. While it is therefore true that each of these classes of electrical companies has an independent standpoint from which it should view the introduction of the accounts to be prescribed under authority of the Public Service Commission's law, it is also undeniable that the interests of all the corporations are identical so far as the treatment of the fundamental principles underlying the accounts is concerned. The commissions will undoubtedly apply the same principles of accounting to the small and the large companies, but will vary the application of the details. The central stations of New York State owe it to themselves to make known their views on the subject of the proposed accounting system while the system is yet in a formative stage, as neglect to do so will seriously handicap any criticism that may be offered after its formal adoption. Moreover, precedents established by the New York State Commission will have a powerful influence in directing the action of similar state bodies, as organized, and the day does not appear distant when practically every state will have a public service commission.

Variable-Speed Stroboscopic Fork.

For determining the exact value of the speed of a rotating shaft no device has been found more accurate than the stroboscopic fork. However, this device has seldom been used outside of physics laboratories on account of the difficulty in adjusting the shaft-speed to correspond with the vibrational-frequency of a certain fork, or in selecting a fork having a frequency corresponding with the speed of a certain shaft. By the use of a rotating target having several patterns of various numbers of positions of symmetry it is possible to estimate the rotative speed of a shaft with a high degree of accuracy throughout a considerable range, but an equipment of this type is inconvenient for general use and is unsatisfactory in cases where the speed is subjected to rapid variations.

As noted elsewhere in this issue, Dr. A. E. Kennelly and Mr. S. E. Whiting presented a paper at the recent annual convention of the American Institute of Electrical Engineers giving a description of a self-contained stroboscopic fork which overcomes the objections raised against the fork method of observing rotative speed. The distinguishing features of the new fork are the adjustability of its vibrational period and its portability. By means of sliding masses on the sides of the fork the rate of vibration may be adjusted through a range of about 5 per cent either above or below its mean value. The fork is used with a five-disk target, which allows it to register the speed of rotation directly throughout a large number of overlapping wide ranges. The fork is driven by an electromagnet connected to a single dry cell, the whole device weighing less than 6 lb., and thus being conveniently portable. The self-contained variable-speed stroboscopic fork possessess many features of value for accurate speed determination, and doubtless will find extensive application in the testing laboratories of colleges and industrial establishments.

A New Source of Illumination.

The aluminum alkaline electrolytic cell has long been known to have rectifying properties when employed in alternating-current circuits, and, in foreign literature, the aluminum alkaline electrolytic cell is commonly referred to as an *electric valve*. It has been recognized, unfortunately, that the efficiency of such apparatus in alternating-current circuits is relatively low, whether used as an electrolytic condenser or as a rectifier, so that the practical application of the apparatus has been much restricted. In an article on page 343, Mr. G. A. Johnstone proposes to turn the inefficiency of the aluminum cell to useful purposes. It is known that when the electrolytic film seals up in resistance, it does not seal up instantaneously, but by a gradual throttling or wire-drawing process. Just as wire-drawing in imperfectly closing steam-valves may be an energy-wasting process, so the wire-drawing in imperfectly closing electric valves is apt to be wasteful of energy. The solution of the cell gets hot, minute electric arcs form on the filmy surface, and Mr. Johnstone suggests utilities for these little arcs. The fact that debasement of the aluminum by addition of copper, tin and other metals in alloy can markedly increase the luminescence of the electrode is a new and useful one. The article suggests, in fact, that if the residual impurities in ordinary commercially pure aluminum could be eliminated, no luminescence might be obtainable. Perhaps the efficiency of electrolytic condensers and rectifiers might be improved in this manner. We can hardly expect an electrolytic cell to become an efficient electric lamp, owing to the large capacity of liquids for heat. Nevertheless, a glow bright enough to read small print by, with an expenditure of only 8 or 10 watts, is worth knowing how to produce, when better sources of illumination are not available. The particular application of this new light detailed in the article is certainly special; namely, the measurement of the slip of induction motors. Ordinarily, the stroboscopic method of making this measurement involves the use of an arc-lamp operated from the same mains that supply the motor. The arc lamp illumines a sectored disk mounted on the induction motor shaft, and since the lamp is flickering at the frequency of the circuit, the sectored disk appears to rotate negatively with the speed of the slip. It is to be presumed that the aluminum cell glow-lamp does not give out light enough to illumine the rotating disk sufficiently clearly, so the rotating sectored disk is used to obscure the lamp.

Physical Valuation of Properties.

One of the most interesting and incisive articles of our current issue is that which summarizes the views and arguments of Mr. Henry L. Doherty, placed by him before the Wisconsin Gas Association, as to the valuation of lighting properties in relation to rates. Perhaps unwittingly, but inevitably because all straight thinking covers a larger field than its own object, Mr. Doherty has at a glance and at a bound brought under one general comprehensive treatment all the problems that now perplex as to the basis upon which a real and true physical valuation of any property may be reached. His analysis of the elements that go to make up the "physical" value of a "property" is as organic and sweeping as anything we have seen; and we shall be glad to receive any prejudicial criticism or subversive analysis of it; for the best thing that can happen in these days is to discover the rock bases upon which values rest. At the same time, as we look over the various items enunciated by Mr. Doherty, all of which have a claim to consideration, and all of which may be rejected by a man who sees everything from the point of ill will and nothing from the point of "good will"—as we look over these necessary elements of integral property value, we are reminded of Henry Ward Beecher when he took a splendid rose, tore it petal from petal, wrecked it utterly as a flower, left it beyond any possibility of resuscitation or reconstitution, and then wished to know what the world gained in any manner by such worthless destruction of "value." It seems to us that much if not all of the modern, academic, socialistic ideas of "physical valuation" embodies that principle of disintegration and diminution against which Mr. Doherty contends so forcibly. On a physical valuation basis that leaves out even other elements than Mr. Doherty counts, the Electrical World is a few desks, some printing presses and a batch of typesetting machines. But neither the Electrical World, nor the *Commoner*, nor the New York Central Railroad can be summed up quite on that plan or philosophy; and their "physical valuation" has a notably larger aspect because they are entities, not fortuitous concatenations of material atoms.

Lightning Protection.

The protection of circuits against lightning is suggestive in a measure of the protection of a ship against projectiles. It makes all the difference in the world whether one is preparing his defence against machine-gun fire or 12-in. shells. Fortunately the former kind of attack, albeit it serves more hits, is in the electrical case the commoner one. In fact, lightning, commonly so called by the station operator, means a relatively mild induced discharge which the arresters, so called, take care of with some degree of certainty, and the cases in which a discharge actually hits a line are comparatively rare. Mr. Creighton's article in our issue of last week gives a capital idea of some of the commoner phases of lightning phenomena. The chief moral that it points is that "lightning" on a line is a phenomenon which is the resultant of many factors depending quite as much upon the conditions existing on the line as upon the particular nature of the fundamental disturbance. An ordinary lightning stroke, involving enormous potentials and the discharge of a huge quantity of electricity, cannot be expected to have in and of itself a high oscillation frequency. In fact, many authorities consider that in effect it is a single discharge followed perhaps by minor tailings, but from the standpoint of energy, mainly non-oscillatory. Occasionally a lightning stroke is evidently composed of a sheaf of discharges, such as are seen in a photograph of the sparks from an induction coil, but such an occurrence is the exception rather than the rule.

Considered as a merely impulsive discharge, however, lightning still has a sort of virtual frequency depending on the slope of the wave front, which may result in impressing a formidable oscillation upon a neighboring line, depending for its frequency ultimately upon the characteristics of that line rather than upon any continued oscillatory stimulus from a continued discharge. Photographed spark-gap discharges appear to show clearly the relation of the line constants to the discharge resulting from induced lightning effects, and it strikes us that there is much worth study in the suggestion that some of the frequencies observed may be due to the line oscillating in segments. The experimental frequencies observed are of course too high by far to correspond with any probable values of the huge capacities involved in cloud discharges. And they are also too heterogeneous and cover far too wide a range to be fairly chargeable to the line fundamental or any of its simple harmonics. They are, however, such as might well be expected if one supposes an inductive impulse of enormous power from a cloud discharge spreading out along a very heterogeneous line. It would be strange indeed if the induced charge resulting should oscillate simply at the line frequency, considering the suspended conductor as a whole. The discharge must obviously be affected by every item of inductance or capacity on the line and by the phase relation between the line e.m.f. and the impulse received. For the purpose in hand the line cannot be considered as having a certain distributed capacity and inductance, but as made up of a string of heterogeneous elements producing an almost infinite variety of reflections and distortions.

Consequently one gets by the composition of these elements with the line e.m.f. a complicated series of oscillations representing nearly everything imaginable except any recognizable fundamental frequency. A sufficient series of experiments might perhaps enable one to pick out the sources of certain oscillations of which the natural frequency of the line would be one, as Mr. Creighton in the absence of the line e.m.f. found out. Later we trust we may be able to disentangle some of the segmental oscillations, and minor causes of ripples like the insulators. It is a tremendously interesting investigation. Incidentally the locus of the disturbing discharge with reference to the ends of the line probably affects the results not only in magnitude but in kind. The chief practical feature of the question is how to secure protection, and this must depend in part on the numerical magnitudes of the electromotive forces in the several oscillations concerned. It is instructive to study the probable value of the guard wire in view of the conditions disclosed. Its exact function is a little difficult to discover unless it is supposed to come to the rescue when the line is actually struck or is a good enough conductor to act as a damping element. We fully agree with respect to the importance of providing means for taking care of a long series of discharges so as to handle line surges due to whatever cause with reasonable certainty. This seems to be the strong point of the electrolytic arrester and of the water-stream apparatus so successfully used abroad. There is great need of an earnest effort at the study and classification of troubles from lightning. Every experimental excursion into this field discloses new complications, and the exact data of accidents from lightning are hard to get at.

Transmission from the Rhone to Paris.

The French government has appointed a commission to report on the feasibility of transmitting electrical energy to Paris from water-powers of the Rhone River, a distance of about 275 miles. The project under study was originally proposed in 1903 by M.M. Blondel, Harlé and Mahl, and contemplates a hydro-electric plant with a capacity of 115,000 kw, the total cost of which is estimated at $12,000,000. Following is an estimate of the amount of electrical energy that will be required by Paris annually in the near future:

Electric traction, subways	100	million	kw-hours.
Electric light and power	300	"	"
Electric traction, street railways, etc.	100	"	"
Railroad electric terminals	125	"	"
Total	625	"	"

To furnish this quantity of energy will require, it is estimated, a plant capacity corresponding to 70,000 kw at the end of the transmission.

International Congress of Inventors.

At a meeting held in Rochester last week, the International Congress of Inventors elected the following officers: President, Mr. Walter S. Strowger, of Rochester; vice-presidents, Messrs. S. Feuerstein, of Rochester, and Mr. Philip F. Dodge, of New York; secretary-treasurer, Mr. Ralph T. Olcott, of Rochester. Additional directors: Messrs. John Heberling and George R. Selden, of Rochester, and Col. John G. Hunter, of Dallas, Tex. Mr. Strowger is president of the Strowger Telephone Company. Mr. Dodge is president of the Mergenthaler Company and chairman of the patent committee of the American Association of Manufacturers. Colonel Hunter is president of the Commercial Club of Dallas and president of the Dallas Council of the International Congress of Inventors.

The report of the secretary-treasurer showed that much progress has been made in securing benefits for investors, and that there is a good balance on hand after an extensive campaign. Plans are under way for active work during the fall and winter toward obtaining favorable action by Congress on bills which will be presented for the establishment of a standard for a United States patent, and for the preservation of models in the Patent Office.

Mr. Joseph J. O'Brien, of Washington, was elected a member. For years Mr. O'Brien has been at work upon an elaborate plan for the reconstruction of the Patent Office.

Mr. C. C. Puffer urged that action be taken concerning the new patent law in Great Britain, which provides that after Aug. 28 one who obtains a patent in that country must manufacture in that country. It was stated that this will work a great hardship on Americans. The following committee was named to prepare a report on English patent law conditions: Messrs. C. C. Puffer, Rochester; Joseph J. O'Brien, Washington; S. Feuerstein, Rochester. A committee on preservation of models in the Patent Office was also appointed, with Mr. O'Brien as chairman. A vote of thanks was tendered the retiring president, George F. Gallagher, who was made a life member.

Electric Railway Accounting.

The proposed scheme of accounts for electric railways in New York State was considered at a joint hearing by the Public Service Commission of the First and Second Districts at Albany on Aug. 4. Representatives of a large number of companies were present and many questions were raised touching the fundamental principles underlying the accounts and details of the text and the method of application. The principal criticism against the tentative classification were based on the provision for depreciation of equipment and depreciation of way and structures account, on the large number of accounts outlined and the fact that the scheme was made retroactive by providing for a reclassification of capital accounts as of June 30, 1907.

Among those who discussed the classification at length were Mr. H. M. Beardsley, secretary and treasurer of the Elmira Water, Light & Railroad Company; Mr. Henry J. Pierce, president of the International Railway & Light Company, of Buffalo; Mr. C. Gordon Reel, vice-president and general manager of the Kingston Consolidated Railway; Mr. C. L. Campbell, auditor of the New York & Stamford Railway; Mr. A. L. Linn, Jr., general auditor of the Mohawk Valley Company; Mr. Howard Abel, comptroller of the Brooklyn Rapid Transit Company, and Mr. A. B. Bierck, auditor of the Long Island Railroad. Mr. Pierce, of Buffalo, confined his discussion to the subject of depreciation. He summarized his arguments as follows:

(a) The change within a very limited period of time from the usual method of street railway accounting whereby no direct charges for depreciation have been made to a system where all depreciation is cared for as by the proposed accounts is unnecessarily violent.

(b) Immediate full charges for depreciation of tangible property, without allowance for appreciation of good will and increased earnings, will necessitate higher rates of fare to enable the payment of a fair return upon the property used.

(c) The power of the Public Service Commission to control the efficiency of the service and the issuance of additional securities for capital account, is sufficient to protect the public interests against waste or capitalization of depreciation.

(d) Charges for depreciation should not be matters of specific accounting, but should be made as an entirety in the discretion of the board of directors, whose intimate knowledge of the condition and growth of the property will enable them to so regulate depreciation charges as to meet their and the corporate obligations, and to conform to the requirements of the law and of the Public Service Commission.

Mr. Abel presented a statement on behalf of all the New York City railways. He discussed in detail various criticisms which had been raised at meetings of the accounting officers of the New York City roads prior to the hearing on the subject of amortization and depreciation. Mr. Abel said that in view of the high standard of up-keep enforced by the Public Service Commission, deterioration cannot be allowed to run to a point where complete renewal or replacement will be necessary; hence, under the scheme of amortization of capital provided for, a conscientious effort to comply in letter and spirit would require writing off to expense an amount during the life expectancy of each class of property equivalent to its cost; the reserve in many cases being more than the surplus earnings. The corporations would be compelled to continue making these reserves and would not be able to draw them down for piecemeal replacements as, until property is completely replaced, the reserve is not available. Such piece-meal replacement or reconstruction would give an indefinite life to some classes of property and the result would be an excessive burden on operation and misleading results. He considered that the enforcement of such theoretical reserves for depreciation, resulting in apparent deficiencies, when actual surplus earnings have been made, will end in costly litigation in the enforcement of proposed method of accounting by the Public Service Commission on the one hand, and by the stockholder on the other suing for dividends, unless such step on the part of the stockholder be rendered unnecessary by receivership proceedings through the enforcement of the bondholders' rights. This, he said, would lead to the same disintegration as has been witnessed in New York City.

Just before the hearing was concluded Mr. Frank W. Stevens, chairman of the Second District Commission, who presided, made a statement outlining the attitude of the commission with respect to depreciation accounts. He said that in making an announcement of its intention to prescribe such accounts the commission had issued statements that were sound and could not successfully be disputed. He stated that the commission recognized the difficulty of establishing such accounts, but that a start had to be made. Concerning the details of the accounts and how they should be conducted for the first few years, the commission seeks all the light possible, Mr. Stevens said, but as to the introduction of such accounts its policy is fixed.

Private Plants and Public Regulation.

Chairman Stevens, of the New York up-State Public Service Commission, has decided that electric plants operated by individuals which perform a public service, even though not incorporated, come under the jurisdiction of the commission. The announcement was made after a hearing in the case of Albert H. and Lynn B. Murdock, of Oneonta, who appeared on an order to show cause why the commission should not begin suit against them for an alleged violation of the Public Service Commission law in operating an electric lighting plant and occupying public streets and places in the village of Oneonta. The order was made on the complaint of the Oneonta Light & Power Company, which now furnishes light to the village. The Murdocks asserted that they were not an electrical corporation, and therefore not subject to the jurisdiction of the commission. They, however, said they did not intend to proceed further in furnishing light or occupying streets in Oneonta, and the matter was dismissed.

Testing Electric Meters in New York

Some months ago the Public Service Commission of New York City began testing the gas meters of private consumers who were dissatisfied with their bills, and last week arrangements were completed for making tests of electric meters. A laboratory provided with every facility of the most modern type has been established and the actual work of making tests of meters has been begun. The commission has already received a number of complaints from consumers in all of the five borough comprising the City of New York.

Under the law an electric meter is deemed to be correct so far as the test is concerned which registers within 4 per cent of accuracy. The law also provides that a fee shall be charged for all such tests which is to be paid in the first instance by the consumer requesting the test. The fee, however, is to be returned to the consumer if the meter shows an inaccuracy of 4 per cent in favor of the company. If the meter is only 3½ per cent fast the consumer loses his fee and the company may or may not install a new meter at its discretion. The fee charged for testing a gas meter is 50 cents, but owing to the fact that an electric meter is more complex a higher scale has been established. The following is a schedule of charges that have been determined upon:

For a meter with a rated capacity of 10 amp or less	$1.50
For a meter with a rated capacity of 15 amp or less	2.00
For a meter with a rated capacity of 25 amp or less	2.50
For a meter with a rated capacity of 50 amp or less	3.00

For each additional 25 amp capacity or fraction thereof the charge will be 50 cents in addition to the above. It will be the purpose of the commission to test all electrical meters complained of under actual conditions of use.

Brooklyn Edison Dinner to Contractors.

The Edison Electric Illuminating Company, of Brooklyn, N. Y., has made a practice for some years past of giving an annual dinner to the electrical contractors working within its jurisdiction, and the affair has been found of great service in bringing different elements of the business together and in promoting harmony and co-operation. The dinner of 1908 was given in the banquet room at Dreamland, Coney Island, on Aug. 4, and was enjoyed by over 150 persons, among whom were numbered the members of no fewer than 80 firms of contractors engaged in construction in the Borough of Brooklyn. The dinner was presided over by Mr. W. W. Freeman, vice-president of the company, who was supported by W. F. Wells, chief engineer; H. F. Frasse, auditor; M. S. Seelman, Jr., sales manager; C. A. Graves, power department, and several others of the staff. There were several representatives of manufacturers present, including Messrs. Beran, of the General Electric; Chase, of the Westinghouse, and Roger Williams, of the Simplex Heating. A most excellent dinner was served, and although the conditions at Dreamland, with its multitudinous crowds and innumerable amusements, are not favorable to oratory, a few brief, pithy speeches were made appropriate to the occasion.

In his introductory remarks, Vice-President Freeman said. "This year when success has not been so easy to achieve, we have done more business than during other years. The contracts of our company for the seven months ending July 31 show that 317,000 equivalents of 16 cp were taken, as against 298,000 equivalents during the same period in 1907. It has been suggested that we form a club of the electrical contractors and all those directly or indirectly interested in the electrical business in Brooklyn to be known as the Kilowatt Club; and at an early date a meeting will be called to discuss the formation of such an organization to meet from time to time and discuss questions of mutual interest."

President C. A. Christensen spoke on behalf of the Independent Electrical Contractors' Association, and Mr. A. S. Beach made an admirable address on behalf of the Electrical Contractors' Association of Brooklyn, insisting strongly on the rights and prerogatives of the contractor and the support to which he was entitled from manufacturing and central-station companies, as the vanguard of electrical progress. Mr. Sol Davis, as president of the New York Electrical Contractors' Association, was also felicitous in his congratulations to the Brooklyn colaborers. Mr. H. S. Wynkoop, representing the city, spoke very earnestly as to the enforcement of rules and regulations and the vital necessity for good, honest work. The concluding speech was made by Mr. T. C. Martin, editor of ELECTRICAL WORLD, who pointed to the fact that this year completed the first quarter century of regular electric service in Greater New York. An evidence of the growth of the industry was shown by the fact that while in 1882 there was not one contractor within the city limits, there were now two important associations with large memberships. This was the age of the contractor. There had been the period of the inventor; there had been the period of the manufacturer and of the central-station development, and this was now the great age of distribution, in which the part played by the contractor was at once essential and vital. Indeed, the problems of the age were mainly those of distribution, and in the electrical field they were second to none in importance. It was a matter of congratulation that already the task had been grappled with so successfully and with such a desire to attain the highest standard of work.

After the dinner each of the party was provided with a combination ticket for the various amusements, and it was not until midnight that the event was brought to a close. It is said to be likely, as an outcome of these annual dinners, that the proposed new organization may take root in Brooklyn representing jointly the interests of the central station, contractor, manufacturer and engineer, so that commercial and technical questions in which all are concerned may be discussed from time to time and dealt with from the standard of the general welfare.

New York Public Service Decision on Competing Systems.

The Public Service Commission for the Second (Up-State) District of New York has granted permission to the Citizens' Electric Service Company, of Bath, to begin construction of an electric lighting plant in that and surrounding villages and towns. The application was opposed by the Bath Electric & Gas Lighting Company on the ground that a competitor would diminish its business and impair the value of its investment, but the commission held that when an existing company fails properly to discharge its duties to the public and does not put its service upon the proper basis it is entitled to little consideration when it seeks to exclude competition. The opinion, written by Chairman Stevens, is that no general rule can be formulated which will indicate with precision when a new lighting company may be permitted to do business in a field already occupied. The conditions prevailing must control the decision.

Conclusive Evidence of the "Overshooting" of Tungsten Lamps and Other Interesting Phenomena.

By J. Stuart Freeman.

Among the rapidly increasing number of users of the tungsten incandescent lamp, doubtless many have noticed what appeared to be a sudden rise in candle-power, upon turning on the current, to far above normal, then a gradual decrease to the operating brilliancy. Of these, however, only one investigator, to my knowledge, has taken it up to the extent of trying to prove that this is a reality rather than a mere illusion. He first stated his suppositions and later constructed apparatus for making a continuous photograph of the intensity of the rays emitted from the lamp after turning on the current, first when the lamp had been cold and again after the lamp had been hot for some little time. This he did by revolving a cylindrical film holder in a lathe at a known speed and feeding before the exposing slot a card with a small hole in it, through which the rays of the light could shine. By this means he demonstrated that there is certainly an "overshooting," as he termed it, of light intensity at the moment of turning on the current, and that it lasts for about one-tenth of a second. This, however, occurred only after the lamp had been turned out for some time, or, in other words, when it was cold. After being lit, then extinguished, and again lit, after the elapse of a second or so, the phenomenon was not visible. This experiment suggested to certain engineers of the General Electric Company the use of the oscillograph in the investigation of the subject. Furthermore, it was deemed advisable to determine, for comparison, the exact action of an ordinary carbon lamp under similar conditions.

In these investigations a 22-volt tungsten lamp, as shown in Fig. 5, was placed in an enclosed tube inside of the oscillograph box so that the light could shine, through a small aperture, onto the revolving film. The current wave was obtained by connecting the vibrator across a shunt in series with the lamp. By means of a contact-making device and a small relay, operated by the same current that controlled the oscillograph shutter, the lamp circuit was automatically closed, thus obtaining on the same film both the current wave and the actual intensity of light emitted from the lamp. All the records were taken from a direct-current source, with the exception of the one shown in Fig. 4. The current went directly to the lamp and instrument, with neither reactance nor resistance in the circuit.

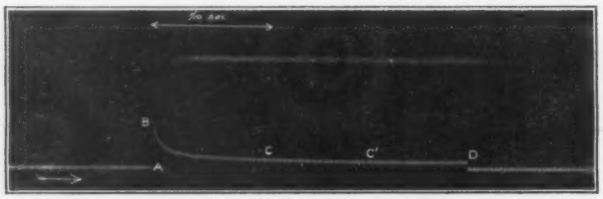


FIG. 1.—OVERSHCOTING OF COLD TUNGSTEN LAMP.

FIG. 3.—ACTION OF CARBON LAMP.

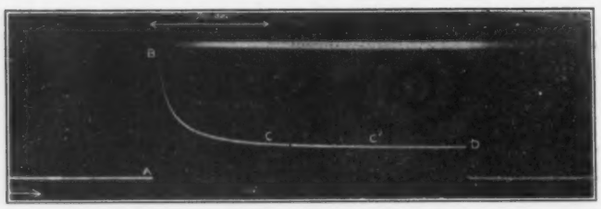


FIG. 2.—ACTION OF WARM TUNGSTEN LAMP.

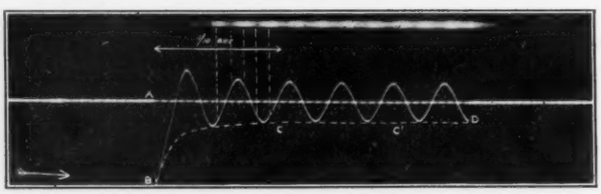


FIG. 4.—BEHAVIOR OF TUNGSTEN LAMP AT 25 CYCLES.

Fig. 1 shows the intensity of light of the tungsten lamp at the top and the current curve directly below. The current was turned on at *A*, jumped to *B* and immediately began to decrease until it practically reached normal at *C*, becoming entirely so at *C'* and remained there until turned off at *D*. Knowing that the 12-in. film was revolving at 113 revolutions per minute we conclude that the total excess of brilliancy lasted for about one-fifth of a second, and the greater excess for one-tenth second. By comparing the corresponding points of the two curves, we see that the difference between the time when the current was turned on and when the filament reached incandescence was very short, being only one-sixtieth of a second, but that the filament held its high temperature for fully one-thirtieth of a second after the current was turned off.

From readings taken, it was shown that the lamp was running on a steady direct e.m.f. of 22 volts and that the initial current was 5.7 amp, while the final current was 0.68 amp. The total exposure to the lighted lamp was one-quarter of a second and the duration of the greatest "overshoot" in the current was about one-fiftieth of a second.

Fig. 2 shows practically the same things as Fig. 1, except that the filament of the lamp was somewhat warm from the first lighting, and, as a result, does not show any "overshooting." However, the oscillating mirror which traced the current curve was so set that it would make that curve on a larger scale than had previously been done; and it also shows that the same ratio existed between the initial current and the final current. This film was somewhat slower than the first, thus producing more of a blurring by the intense light.

By referring to Fig. 3 we find that an entirely different state of affairs exists in the case of a carbon incandescent lamp of the same candle-power, namely, 16. This was also run on a direct current with no resistance in the circuit. The voltage was 120 and the initial current was but 0.15 amp, while the final current was 0.3 amp. The current, turned on at *A*, jumped to *B* and rose gradually to *C*—the normal operating intensity—where it continued until turned off at *D*. This film was revolved at the rate of 120 revolutions per minute, showing that it took approximately one-fifth of a second for the current to become normal. This easily illustrates the comparative susceptibility of filaments made from each of the two elements.

By comparing these two records we find that while the current of the tungsten lamp "overshoots" its normal point of operation when turned on and then decreases to it, the current of the carbon lamp starts low and increases to normal, at no time exceeding that point. Further, the difference in the number of watts necessary to produce 16 cp in each of the two lamps is quite noticeable, for while the tungsten lamp, running on 22 volts, started at 5.7 amp and ran on 0.68 amp, the carbon lamp, running on 120 volts, started on 0.15 amp and ran on 0.3 amp.

Lastly, in Fig. 4 we have a record made from a film revolved at 120 revolutions per minute showing all of the above characteristics concerning the tungsten lamp, and an additional phenomenon, which I think has never been shown before. In making this record, a 25-volt tungsten incandescent lamp was run on a 25-cycle, alternating-current circuit. The current kick

is shown at the instant of closing the circuit, and also the alternate heating and cooling of the filament, corresponding to the alternations of the current wave. On closing the circuit there were 3.1 amp effective, while at normal there was but 0.3 amp effective. It will be noticed, however, that the filament begins to brighten at the maximum point of the wave, and itself reaches a maximum at one-eighth of a cycle farther

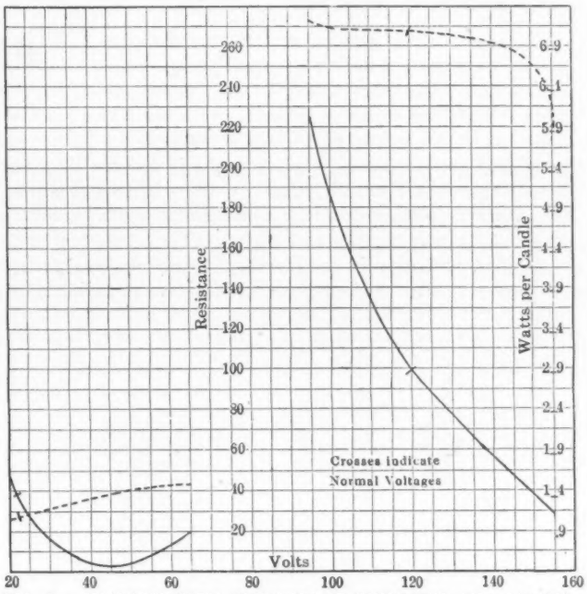


FIG. 5.—CHARACTERISTIC BEHAVIOR OF TUNGSTEN AND CARBON LAMPS.

along, or a point midway between maximum and zero on the descending part of each wave. Also that the minimum brilliancy is not at zero, as might be expected, but at one-eighth of a cycle farther along.

As a result of these tests there seems to be no question that the suppositions of the first investigator, who made known his experiments in this line, and others thinking the same way, are correct; and there is nothing further that can be done to prove more conclusively the above, since clear records made by the oscillograph are universally accepted as proof.

For the purpose of showing the corresponding running currents of tungsten and carbon lamps of the same candle-power, Fig. 5 is given. The long solid curve to the right shows the decrease in watts per candle-power for an increase in voltage in an ordinary 16-cp carbon lamp. The dotted line above shows the *decrease* in resistance with a *rise* in voltage, which fact is characteristic of the carbon filament—the element carbon having a negative resistance coefficient. For the record of the tungsten lamp we have to look down into the lower left corner, and here the solid and dotted line refers to the same tables as do those of the carbon lamp. However, we noticed that the resistance curve *rises* for an *increase* in voltage, which fact is characteristic of all metal filaments, since they have positive resistance-temperature coefficients. This also shows why, in Figs. 1 and 3, the current acted as it did—in the one case the resistance *increasing,* with an *increase* in temperature, causing a *decrease* in current, and in the other the resistance *decreasing* causing an *increase* in current with an *increase* in temperature.

Moreover, the comparative lives of the two lamps are suggested by the curves. The tungsten runs normally on 22 volts, but ran on 65 volts for a short time before burning out, or on *three times its running voltage.* In the case of the carbon lamp, running normally on 118 volts, it burned out finally on 155 volts, or at only *one and one-third* times its rated voltage.

The Jubilee of the Atlantic Cable.

Reference was made in these pages last week to the jubilee of the Atlantic submarine cable, Aug. 5. On both sides of the ocean this notable anniversary has naturally attracted attention and evoked a generous flood of reminiscence, comment and congratulation. It is understood that the electrical exhibition this fall in New York will emphasize the event, and that, as an old telegrapher, Mr. Thomas A. Edison has consented with characteristic enthusiasm to serve as president of the show to be given in Madison Square Garden in honor of what happened 50 years ago.

There is still an inclination to date submarine telegraphy from the episodes of the Atlantic cable, a state of mind that overlooks and forgets all the brilliant pioneer work done by Englishmen in laying stretches of cable, prior to 1857, across all the narrow but deep bodies of water that circumscribe the British Isles and mark the geographical limits of Europe. That which Cyrus Field did is worthy of all honor, but he had both example and precept in the cable work in the North Sea,

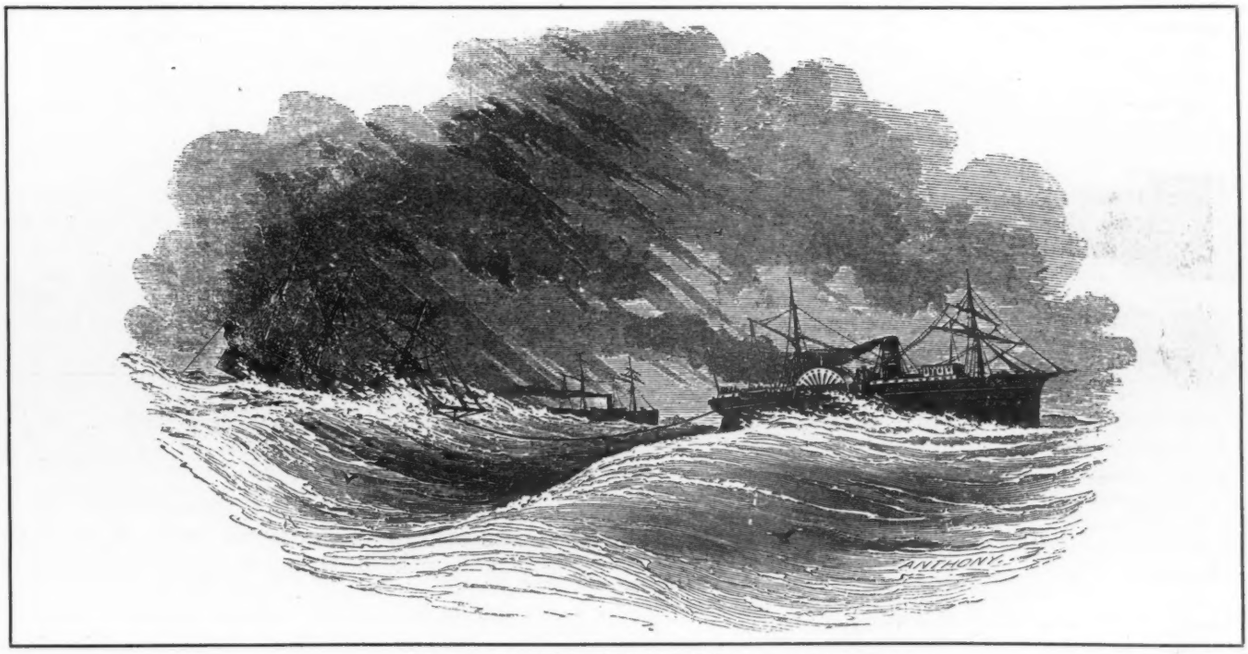


FIG. 1.—THE FIRST TELEGRAPH FLEET IN A GALE.

the Mediterranean, the English Channel, and even the waters of New York harbor. More than that, he had the splendid prophetic support of Morse, who on Aug. 10, 1843—no less than 65 years ago—wrote to the Secretary of the United States Treasury as follows, after referring to Ohm's law: "The practical inference from this law is that a telegraphic communication on the electro-magnetic plan may with certainty be established across the Atlantic Ocean. Startling as this may now seem, I am confident the time will come when this project will be realized." On June 10, 1871, the day that Morse's statue was unveiled in Central Park, New York, the venerable inventor in a speech at the Academy of Music said: "In October, 1842, the first submarine telegraph cable was laid by me, one moonlight night, in the harbor of this city, which proved experimentally the practicability of submarine telegraphy; and from the results of this success I ventured, the year after, in a letter to the Secretary of the Treasury, to predict the certainty of an Atlantic telegraph." Professor Morse then went on to discuss what had actually been accomplished and said: "To Cyrus W. Field more than to any other individual belongs the honor of carrying to completion this great undertaking."

The first attempt to lay the Atlantic cable was made in 1857. The cable broke when only 300 miles had been laid. In 1858 the attempt was renewed with the U. S. steamer *Niagara* and the British man-of-war *Agamemnon*, which, meeting in mid-ocean, spliced the ends of their cable and sailed for shore. The cable broke, and again the rendezvous was made in mid-ocean. After repairs and landings the whole line was actually completed on Aug. 5, 1858, and on Aug. 16 Queen Victoria and President Buchanan exchanged their cordial felicitations. As John Bright said: "The Old World has been moored alongside the New."

Once more the primitive, ill-designed cable broke, and all through the throbbing days of the Civil War it lay silent in the ocean ooze. In 1864 fresh capital was raised for the enterprise; in 1865 the *Great Eastern* sailed and laid 1200 miles of cable, when a sudden pitch of the vessel snapped the cord. The attempt was renewed successfully in 1866; the old cable of 1865 was picked up, and spliced in, and never since then has submarine cable communication ceased between the two hemispheres. Had it failed, the overland telegraph by way of Alaska and Siberia would have taken its place, and a very different history of Asiatic and Japanese development might have been the result. In 1867, Vice-President Orton—afterward president of the Western Union Telegraph Company—wrote to Secretary Seward as follows as to the abandonment of the Asiatic route to Europe: "All doubts concerning the capacity and efficiency of the ocean cables are now dispelled, and the work of construction on the Russian line, after an expenditure of $3,000,000, has been discontinued."

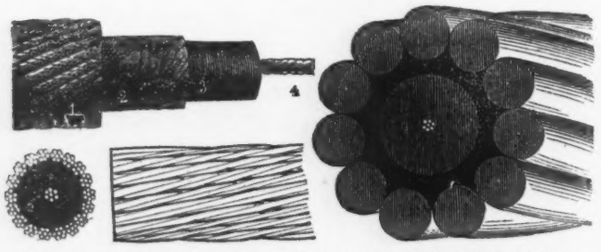


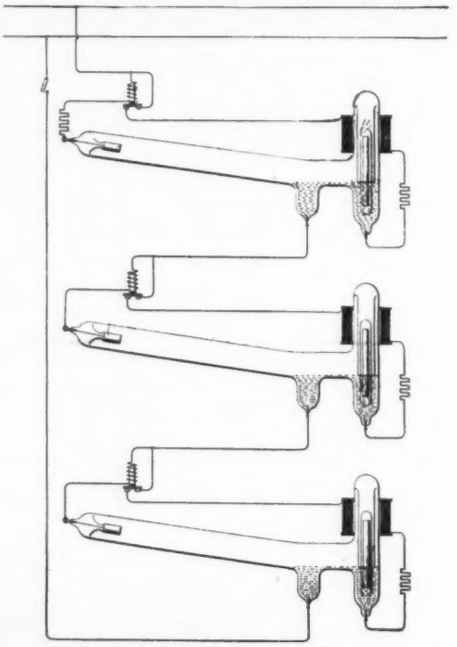
FIG. 2.—SECTIONS OF FIRST DEEP SEA AND SHORE END CABLES.

At the present moment, 247,888 miles of submarine cable are in operation, inclusive of 16 cables in the Atlantic. It is said that seven cables have been abandoned, but that number seems to include the cables of 1858 and 1865, both of which were picked up.

The completion of the cable of 1858 was marked by great rejoicings; and in New York City Sept. 1 was made a public holiday, with parades and illuminations. In England the success led to the conferring of many titles and honors on those who had participated actively in the expedition, while in America, Mr. Field was the recipient of many evidences of esteem and approbation. A fine portrait group of him and his associates, by Huntington, now hangs in the great hall of the Chamber of Commerce of New York, as a souvenir of the occasion, and as a recognition from the industry and commerce of the United States for the great boon of the Atlantic cable.

Operating Vapor Electric Lamps.

A patent issued July 28 to Mr. E. Weintraub described a means whereby a plurality of vapor lamps may be operated in series with each other either in a constant-current circuit or from a source of constant potential. The method of connecting lamps is shown in the accompanying illustration. The type of lamp employed is one in which starting is secured by means of a supplementary electrode, shown to the right of the tube, between which and one of the main electrodes a small arc is initiated, thereby serving to start up the arc between the main electrodes. Floating in the mercury of the supplementary electrode is a small closed glass tube closely surrounding a rod of iron which constitutes a core for an outer solenoid. When current passes through the solenoid after the main arc has been established, the core is lifted, which causes the small quantity of mercury uniting the two electrode cups to flow into the auxiliary electrode cup, thereby breaking the auxiliary starting circuit. Auxiliary resistances, shown on each side of the upper lamp and to the right of the other two lamps, are inserted to limit the current to a given value and to make the arcs more stable; when the lamps are supplied from a source of current of constant value, these resistances are not required. The coil of the starting solenoid is cut out by means of a contact device, shown to the left and above each tube.



METHOD OF CONNECTING VAPOR LAMPS.

Disturbance to Telephone and Telegraph Wires by Single-Phase Railway Circuits.

If a low-voltage conductor, such as a telegraph or telephone wire, extends in close proximity to a conductor carrying single-phase alternating current, the low-voltage conductor is subject to disturbances due to induction both static and magnetic. Thus, in a single-phase alternating-current railway a telegraph wire on the same poles with the working conductor is subject to such disturbances. The disturbances due to magnetic induction are largely avoided when substations are connected to both ends of the working conductor. For instance, if a section of the working conductor extending between two substations

is considered, it will be seen that with a car in the middle of the section, the current in one-half the section will neutralize the inductive effect of the current in the other half, and when the car is not in the center the tendency to neutralization continues, since when the car is nearer one end of the section than the other, the shorter part of the section carries a greater current.

A patent issued June 16 to Mr. A. H. Armstrong discloses means for preventing the disturbing effects of static induction. The inventor makes use of the catenary which is usually employed in the suspension of trolley wires, and he provides means for maintaining this catenary at a potential approximately equal but opposite in time-phase to that of the trolley wire. By the use of a transformer whose middle point is grounded to the rail and whose two terminals are connected respectively to the catenary and to the trolley wire, the potential wave of the catenary at each instant is equal and opposite to that of the trolley wire. Under this condition, a telegraph or telephone wire located in proximity to the trolley wire will be subject to the static inductive effect of both the trolley wire and the catenary, and owing to the fact that the voltage of these conductors is at every instant approximately equal but opposite the resultant effect on the adjacent telegraph or other wires will be nil.

The overhead system differs from the usual catenary system in that insulators are inserted in the supports which serve for suspending the trolley wire from the catenary.

Volatile Matter in Coal.

A paper presented at the June meeting of the American Chemical Society by Dr. Horace C. Porter described an investigation conducted by the Technologic Branch of the United States Geological Survey for determining the hydrocarbons given off by coal at different temperatures.

The objects of the investigation were to throw light on the nature of the volatile products from coal, and on the manner in which they are affected by the conditions prevailing during their formation or to which they are subjected after formation; to contribute, in the interests of smoke abatement, some data on the comparative amount and character of the gases and vapors distilled from different coals at low temperatures, a subject intimately concerned in the production of smoke; to prove experimentally that the volatile product of coal is to some extent incombustible, and that the proportion of inert volatile varies in different coals; and finally, to show that the oxygen of coal is in many cases evolved in the volatile matter very largely in combination with carbon as CO and CO_2, as well as with hydrogen as water, thereby explaining in great degree the discrepancy found in these cases between the determined calorific value and that of Du Long's formula.

The importance of the role played by the volatile matter in all industrial applications of fuel is generally recognized. There are more heat units in the volatile matter in proportion to its weight than in the fixed residue. Pittsburg coal of 30 per cent volatile matter and 7 per cent ash has 36 per cent of its heat value in its volatile matter, as shown by comparing the heat values of coal and coke. When coal is fired under a boiler, either by hand or mechanically, it first undergoes a process of distillation, and both the quantity and quality of the volatile products and the relative ease of their liberation are concerned very largely in the boiler efficiency and the production of smoke. It is reasonable to suppose that coals of different origin may yield volatile gases carrying different percentages of tarry vapors and heavy hydrocarbons and may, on that account, differ in smoke producing tendencies. A knowledge of the chemical reasons why coals smoke in varying degrees, and why high volatile coals are hard to burn with maximum efficiency, is a necessary preliminary to the taking of intelligent steps toward improvement in these respects.

The gas producer for bituminous and low-grade fuels is coming more and more into favor. Here also the volatile matter in the fuel plays a very important role, since at the top of the fuel bed a process of distillation is continually going on. A certain proposed new type of producer will utilize high volatile fuels, such as bituminous coal, lignite, peat and wood, by passing the hot gases from the producer through the raw fuel in a series of preliminary chambers, thus distilling the valuable hydrocarbon gases (as well as ammonia) out of the fuel before it is charged into the producer itself.

Attention need hardly be called to the pre-eminent importance of the volatile matter of coal in the illuminating gas and by-product coke oven industries. It is of interest to note, however, the increasing favor accorded by the gas industry to the vertical gas retort as most successfully operated by the Bueb system in Germany, and to explain that one advantage of this process lies in avoiding decomposition of certain valuable gases in passing over heated surface, as occurs in the ordinary processes, although at the same time a higher gas yield is obtained by using higher temperatures in the retort itself.

In connection with a series of experiments not yet completed, on the deterioration in heat value of various coals during storage under different conditions, a liberation of gas in remarkably large quantities was found in certain cases. About 25 lb. of bituminous coal of buckwheat size was stored in a 5-gal. glass bottle closed with a rubber stopper, which was provided with glass tubes for removing gas samples. The bottles stood in the laboratory at a temperature ranging from 20 deg. C. to 25 deg. C. In some of the bottles the coal was immersed in distilled water and the interstices well filled with water by attaching a partial vacuum for about one hour. About 400 cu. cm of air remained above the surface of the water.

The gas liberated during these experiments consisted almost entirely of methane with a very slight amount of CO_2 and no more than doubtful traces of CO and heavy hydrocarbons. No hydrogen could be detected by the palladium fractional combustion method. Whether this gas may properly be considered as volatile matter due to decomposition of the coal, or whether it is held in the coal as such by occlusion or absorption cannot be decided without further study. The fact that the oxygen of the air surrounding the coal was rapidly absorbed without forming CO_2 indicates a change of composition in the coal. It is reasonable to suppose that a larger quantity of gas escaped between the mining of the coal and the starting of the experiments than was measured during the experiments. The measurement of quantity of gas formed is therefore of little value. The gas pressure in the case of one coal immersed reached at one time 7 in. of mercury.

A series of experiments conducted primarily for the direct weighing of moisture driven off from coal at 105 deg. C. yielded results incidentally which showed the extent of the loss of substances other than moisture, principally CO_2 in small percentages.

In studying the nature of the volatile matter at the medium and higher temperatures (500 deg. to 1100 deg. C.) two sets of experiments were run, using a different apparatus in each. In one a small sample (10 grams) was heated in a platinum retort suspended in an electric resistance furnace maintained at a constant desired temperature, the gases evolved being collected by displacement of water in a bottle. No attempt was made in this set of experiments to duplicate the methods of industrial practice. The apparatus was designed with the idea of maintaining definite and controllable conditions which would yield results comparable with each other in experiments on different scale. The other set of experiments was run on a somewhat larger scale, heating 400 grams of coal in a cast-iron retort resting in a cylindrical electric resistor furnace, the tar, water, ammonia, CO_2, H_2S, and gas being collected in appropriate absorption apparatus and measured. Owing to the heavy nature of the retort and the large sample of coal the temperature in the coal could not be varied as easily in these experiments as in those using the platinum retort. Accordingly one set of conditions was adopted approximating as nearly as possible those of industrial by-product coke oven practice, and a number of typical coals were compared under these conditions

A series of tests on 10 grams of coal in a platinum retort, at various temperatures, is not yet completed, but it has yielded sufficient results to show their approximate agreement with those obtained on 400 grams of coal.

Four coals were tested, samples being obtained from Connellsville, Pa.; Ziegler, Ill.; Sheridan, Wyo., and Pocahontas, W. Va. The tests showed that at 700 deg. C (565 deg. C. in the coal) the Connellsville is the richest of the four coals in illuminants and heavy hydrocarbons and the Pocahontas the highest in hydrogen. A a result of the tests the following conclusions seem justified: (1) Some coals liberate gas during storage, of a composition similar to that of natural gas, and some coals rapidly absorb oxygen from the air during storage without forming CO_2. (2) During drying in air at 105 deg. C. some coals lose appreciable amounts of CO_2, and most coals take up oxygen to a considerable formation of combustible gases. (3) The nature of the volatile products distilled from several coals at low temperatures in the early stages of heating vary in different coals in accordance with their smoke-producing tendencies. (4) The volatile matter of coal comprises a considerable proportion of non-combustible matter, varying with the type of coal.

CURRENT NEWS AND NOTES.

SILICO-VANADIUM STEEL.—The Pittsburg Transformer Company has issued a pamphlet giving an interesting account of silico-vanadium steel and its process of manufacture from the time the ore leaves the ground to the finished sheets in the annealing furnace. As the illustrations and descriptions apply to a considerable extent to the manufacture of all kinds of steel, the pamphlet, aside from appealing to users of transformers, has a general interest.

HEADING OFF PARIS STRIKE.—Last week the electrical labor unions in Paris, with no grievance of their own, but attempting to help a general "sympathetic" strike, went out, leaving the plants idle and plunging the city into relative darkness for two hours. President Clemenceau gave orders for the electrical corps of the army to stand ready in the event of a repetition of the trouble the next night, and this prompt action led to the instantaneous abandonment of the strike, which had greatly inconvenienced the public, but had no excuse.

TELEPHONE FOR D., L. & W. TRAIN DISPATCHING SERVICE.—The Delaware, Lackawanna & Western R. R. has decided to replace the telegraph with the telephone for train dispatching service. At present the telephones are operated by the telegraphers, but it is probable that after the system is in thorough working order there will be a considerable reduction in the number of operators. For several weeks all trains passing between New York and Binghamton have been operated by the telephone system and so far no defect has been found and not a single mishap has resulted.

WIRELESS ON THE AMAZON.—Advices from Lima state that telegraphic communication is now open with Iquitos, on the River Amazon. The means of connection from Lima to Puerto Bermudez is an ordinary wire telegraph line, but from Puerto Bermudez to Iquitos, the distance of about 1000 km, including long stretches of primeval forest, is bridged by wireless. The original intention of the Peruvian government to connect Iquitos with the outside world by wire was given up on account of the immense difficulty and cost. The Telefunken Company, putting in the system, succeeded in establishing the service on the whole "line" within two years. The expense of installation, defrayed by the Peruvian government, reached about $200,000.

COPPER MINE ELECTRIC HOIST.—The Veteran copper mine, one of the Cumberland-Ely properties, has recently installed a 300-hp electric hoist which is proving very economical in the use of power. This hoist is one of the largest in use in copper mining, and has an overload capacity of 50 per cent. Its normal work only calls for about 240 hp. Six tons of ore are handled smoothly at each lift, and dumping is automatically performed from the hoist into the bins. There is no occasion for the presence of a single laborer in the handling of the mine's output, and it has been found that it costs a great deal less to send power over the wire to the motor than to haul fuel up the grade from the town of Smelter. The operating charges are, as a result, much lower with the electric hoist than could be obtained by the use of steam, and there are no apparent advantages of steam to offset the economy of electric power.

FIVE-CENT FARES FOR CLEVELAND.—After having fought for years for three-cent fares, Mayor Johnson, of Cleveland, may have to order that five-cent fares shall be resumed on lines controlled by the municipality. At present it is proposed to collect five-cent cash fares, but to continue to sell tickets for three cents. This policy is said to be the result of a considerable deficit in the operating of the street-car system, which a few months ago was taken over by the Municipal, a holding company, to be operated on a straight three-cent basis. Officials of the Municipal are said to favor the new rate until "prepay" cars are in use, when it is thought practically all fares will be collected. The growing deficit, it is asserted, is due largely to the free transfer system begun a short time ago on trial, together with "indifferent collections by conductors."

LOWER CABLE RATES.—A special dispatch from London, England, of Aug. 8, says: "Many newspaper articles this week commemorated the fiftieth anniversary of the completion of the first Atlantic cable. In several instances hope was expressed that the near future would see some reduction in transatlantic rates. Rolland Belport, who writes with some authority on the subject, suggests new developments in this direction. 'Fifty years ago,' he says, 'there was one company and one cable. The tariff was £1 a word, the speed scarcely 10 words a minute, and the revenues insignificant. To-day there are six companies, 15 cables, the tariff 1s. a word, and the annual revenue about £1,400,000.'" The shilling—25-cent—tariff has been in force about 20 years, and there is a possibility that a project for the establishment of a new Atlantic company, with a sixpenny—12-cent—tariff, may shortly be submitted to the public Certainly there is room for such a company, which could start with many financial and other advantages not enjoyed by the old companies.

LIGHTS AS MOTH TRAPS.—This year has been noted for its swarms of moths and butterflies, and as usual in several places the attraction of the electric light has been noted, especially where arcs are burned. The use of arc lights as traps is not indulged in by American authorities, but a special cable dispatch from Zittan, Germany, says: "The Saxon authorities have discovered what would seem to be an excellent way to put an end to the caterpillar plague, which is having such a disastrous effect on the local forests. They have discovered a method to catch the brown moths that lay the eggs from which the caterpillars come in enormous quantities. They make use of what they call the electric light trap. This consists of two large and powerful reflectors placed over a deep receptacle and powerful exhaust fans. The whole has been erected on top of the municipal electric plant. At night two great streams of light are thrown from the reflectors on the wooded mountainsides half a mile distant. The results have been astonishing. The moths, drawn by the brilliancy, come fluttering in thousands along the broad rays of light. When they get to a certain distance from the reflectors the exhaust fans take up their work, and with powerful currents of air swirl them down into the receptacle. On the first night no less than three tons of moths were caught. It has been decided to build another trap on the Rathaus tower and the fight will be continued."

Non-Synchronous Generator Stations of the Rheinbinnencanal, Switzerland.

By M. YAZIDJIAN.

THE frequent occurrence of floods in the fruitful valley of the Rhine between Lake Constance and the mouth of the Ill River, due to the high level of the river, rendered its correction and regulation very necessary. Attempts at canalization had been made continuously for several centuries, but without complete success, until in 1892 Austria and Switzerland came to an agreement for an international regulation of the Rhine. This regulation consisted in diverting the river by means of a canal between Brugg and Fussach and at Diepoldsau, the former shortening the river by 7.5 km (4.7 miles) and the latter shortening it by 2.5 km (1.6 miles). The first canal is, in places, up to 4 m deeper than the part of the river it has replaced. The water level is, however, always higher than the valley itself.

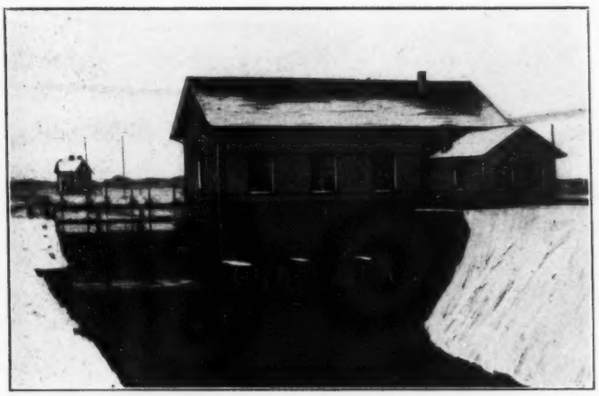


FIG. 1.—CENTRAL POWER STATION AT MONTLINGEN.

In order that the water coming from the mountains at either side should not accumulate in the valley, special canals, parallel to the Rhine, were constructed to gather this water and conduct it directly to Lake Constance. One of these canals is called the Vorarlberger Binnencanal (Austrian side) and the other the Rheintalische Binnenkanal (Swiss side). Parallel to the latter, between Oberriet and Kriesern, is a third canal, the Zapfenbach Krummenseecanal, 8 km (5 miles) long. The amount required to complete these undertakings was more than 15,000,000 francs ($2,850,000), but by means of them the valley has been effectively protected against floods and large areas of land have been reclaimed for agricultural purposes.

TABLE I.

Falls.	Water quantity cu. meter per second.	Effective fall in meters.	Effective turbine power 78% Efficiency hp.	Average duration during last 13 years.
		Lowest Water.		
Lienz	5.2	3.96	214	
Blatten	5.6	3.75	218	365 days per annum.
Montlingen	5.9	3.65	224	
			656 hp.	
		Normal low water.		
Lienz	8.3	3.75	322	
Blatten	9.0	3.54	331	319 days per annum.
Montlingen	9.5	3.45	340	
			993 hp.	
		Mean Water.		
Lienz	10.4	3.61	390	
Blatten	11.2	3.40	396	285 days per annum.
Montlingen	11.8	3.37	414	
			1200 hp.	

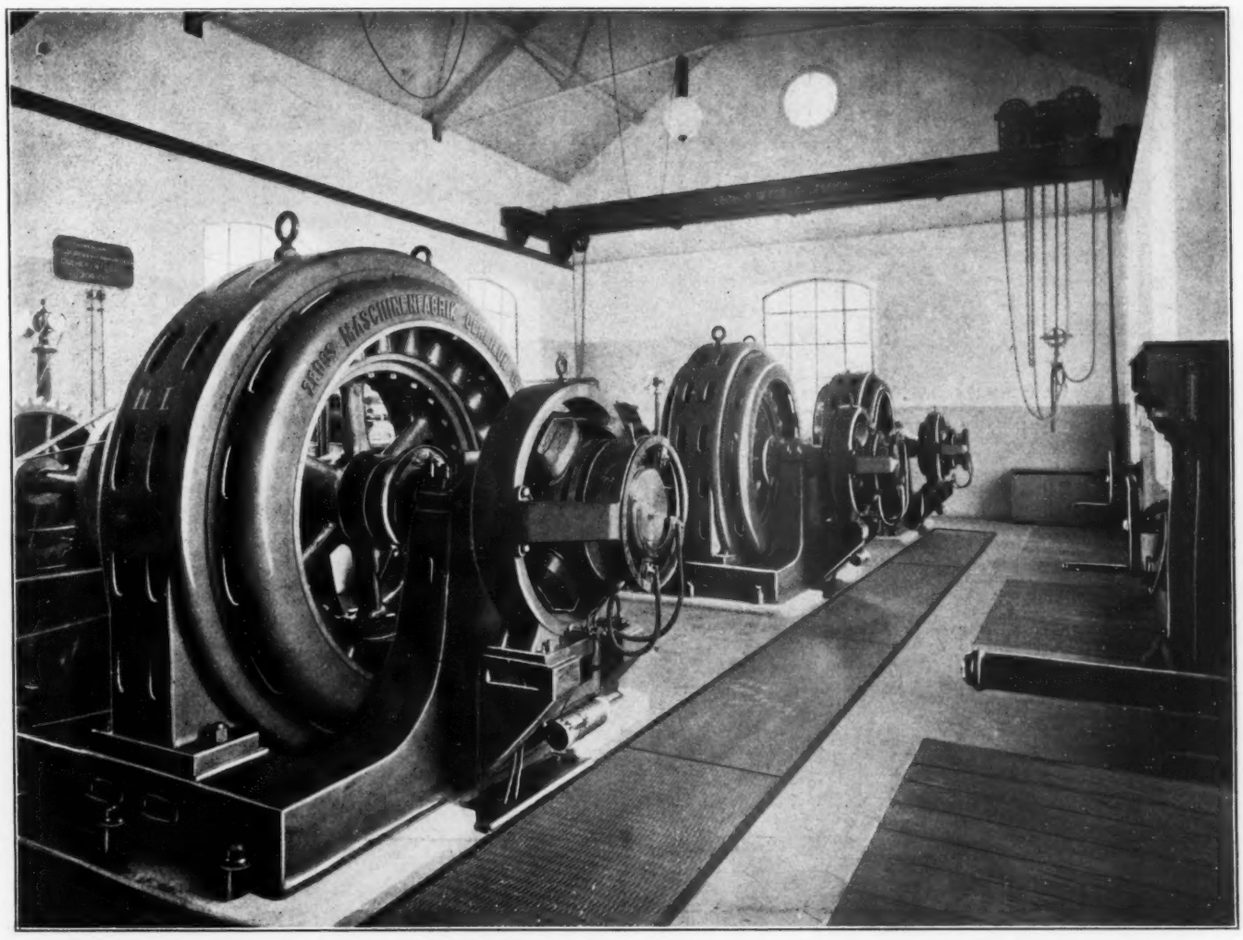


FIG. 2.—MACHINE ROOM OF MONTLINGEN POWER STATION.

On account of the contour of the land the Rheinbinnencanal is constructed in three distinct steps and has three falls 3, 4 and 4 m in height. The first of these falls is in Lienz, the second in Blatten and the third in Montlingen, the three being about 5 km (3 miles) from each other.

Table I gives the water quantities and the power which can be obtained from the different falls.

As the quantity of water carried by the Rheinbinnencanal

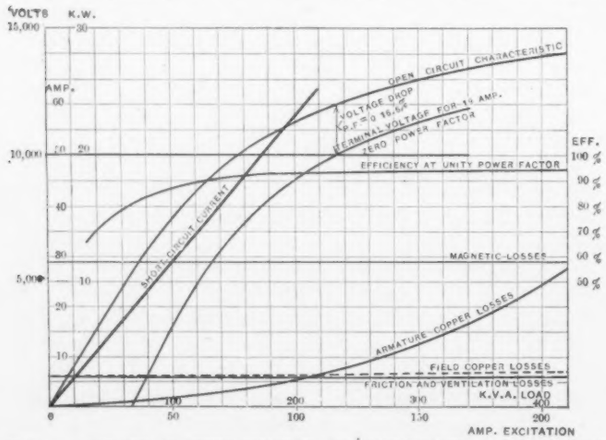


FIG. 3.—CURVES OF TEST RESULTS OF SYNCHRONOUS GENERATORS.

was too small during the summer, it was decided to direct into it a part of the water of the Werdenberger canal and thus permit a sufficient and regular supply to the three power-stations which were planned. For this purpose a connecting canal, 30 m long, with weir, sluice, etc., was constructed and thus the amount of water supplied to the Rheinbinnencanal can now be regulated.

The utilization by means of electricity of the power available in Lienz, Blatten and Montlingen was decided upon and three-phase current was chosen for the purpose. The three stations were to work in parallel, as it would not be possible to feed a separate network with each of them. Taking into consideration the difficulties which parallel operation and voltage regulation present in such cases the Oerlikon Works submitted a plan which avoided all these difficulties and finally obtained the contract for the installation of the whole electrical equipment.

In the station at Montlingen, ordinary synchronous generators are installed. All the regulating work is done in this station.

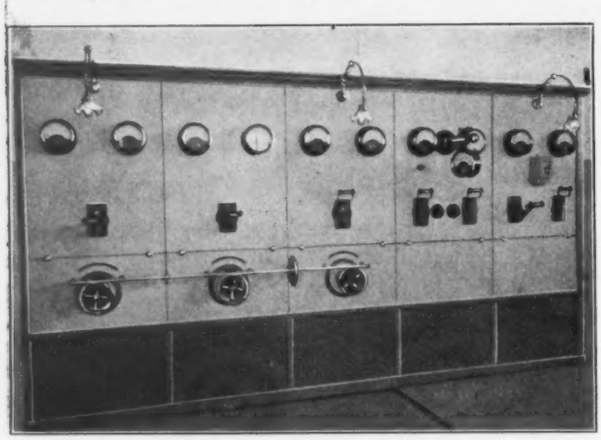


FIG. 4.—SWITCHBOARD OF MONTLINGEN STATION.

The other two stations are equipped with non-synchronous, or induction, generators which are simply short-circuited induction motors run above synchronous speed. Owing to the novelty of the system, some preliminary remarks on non-synchronous, or induction, generators and the advantage resulting from their use in central-station work may be of interest. Their well-known properties are as follows:

They generate a watt current when run above synchronous speed and when the wattless component of current necessary for excitation is supplied from an external source; this source can be a synchronous motor, synchronous generator or a battery of condensers; in fact, anything capable of producing a lagging current. No wattless component of current can be produced by the generator itself; it cannot therefore be considered as a self-exciting machine. Without any external voltage it cannot generate by itself any e.m.f. They have no action on the line voltage and can be thrown in parallel without the aid of phase lamps. For a given frequency and terminal voltage the current depends upon the power supplied by the prime mover. For a given load these generators have a definite speed above synchronism.

On account of the above properties, the danger resulting from short circuits in the lines is much smaller for induction than for synchronous generators. Furthermore, the induction generators are simpler and more substantial in construction than synchronous generators and therefore depreciate less rapidly.

The principal disadvantage of such a system is that the synchronous generators used work with very low power-factors, as they have to furnish the wattless component of current necessary both for the network and for the induction generators; consequently their nominal power must be greater than that of corresponding generators in an installation of the usual type having synchronous machines only.

It was found, however, that the relatively low cost of short-circuited induction generators, as compared with ordinary generators having direct-current excitation, added to the simplicity

FIG. 5.—NON-SYNCHRONOUS POWER STATION AT BLATTEN.

of the switchboard, counterbalanced the increase in cost resulting from the above disadvantage. On the whole, this installation has been found to be rather more economical than if three synchronous power-stations had been erected in the usual way. Another disadvantage of the system is the fact that the induction generator stations are dependent on the synchronous generator station, and in case of breakdown of the latter, the former cannot supply energy.

The operation of the stations of Blatten and Lienz is very simple. The attendant has simply to switch generators in and out when synchronous speed has been approached, after opening or closing the turbine valves according to telephonic orders received from the synchronous generator station. The attendants in these two stations do not therefore require any special training, the whole of the regulation being concentrated in the hands of the chief electrician in the central station at Montlingen. The operating expenses are thus appreciably diminished. This fact has also had a great influence on the choice of the system.

CENTRAL STATION AT MONTLINGEN.

This station (Fig. 1) is about 1 km from Oberriet (St. Gall) and is equipped with three generating sets (Fig. 2). The turbines are of the Francis type, rated at 250 hp and running at 75 r.p.m. They are connected with horizontal synchronous generators by means of bevel gearing. The leather link coupling between the generator and the turbine is constructed as a double pulley and serves to drive the oil pump and the centrifugal regulator of the governor, which is of the Escher-Wyss type.

The generators are of the revolving-field type and have a nominal rating of 330 kv-amp, generating current at 10,000 volts and 50 cycles and running at 250 r.p.m. Their principal dimensions are: Stator, internal diameter, 1600 mm; stator, external diameter, 1930 mm; width of armature core, 330 mm. The armature has 72 slots, 26 x 53 mm, with 55 conductors of 28/3.2 mm wire in each. The stampings are 0.3 mm thick, with paper insulation. The 24 exciting poles connected in series are built up of 0.5 mm stampings, wound with 44½ turns of 2/30 mm copper strip. The pole ring is of mild steel. The exciter is coupled direct to the generator and furnishes a current of 130 amp at 60 volts.

The results of tests on the above generators are shown by the curves in Fig. 3. It will be seen that the voltage drop for zero power-factor is only 16 per cent. The machines have been run at an overload of 30 per cent for several hours without any great rise of temperature.

are provided with a common regulating system, but each machine can also be separately regulated. The fourth panel is for the lines coming from the non-synchronous stations and for the feeder distributing the energy to Oberriet. The fifth panel is for the Altstätten and Berneck feeders, each of which has in circuit a three-phase switch and an ammeter.

There is in addition a three-phase supply meter to measure the total energy furnished, a wattmeter for the power supplied by the synchronous generators alone, a voltmeter with the necessary switch for the voltage measurement of the generators and busbars and two-phase lamps for use in paralleling the machines.

The apparatus rooms are divided into separate compartments by means of reinforced concrete partitions. The generator compartments each contain oil fuses, a potential and series transformer for the instruments and an oil switch operated from the switchboard. A special compartment contains a

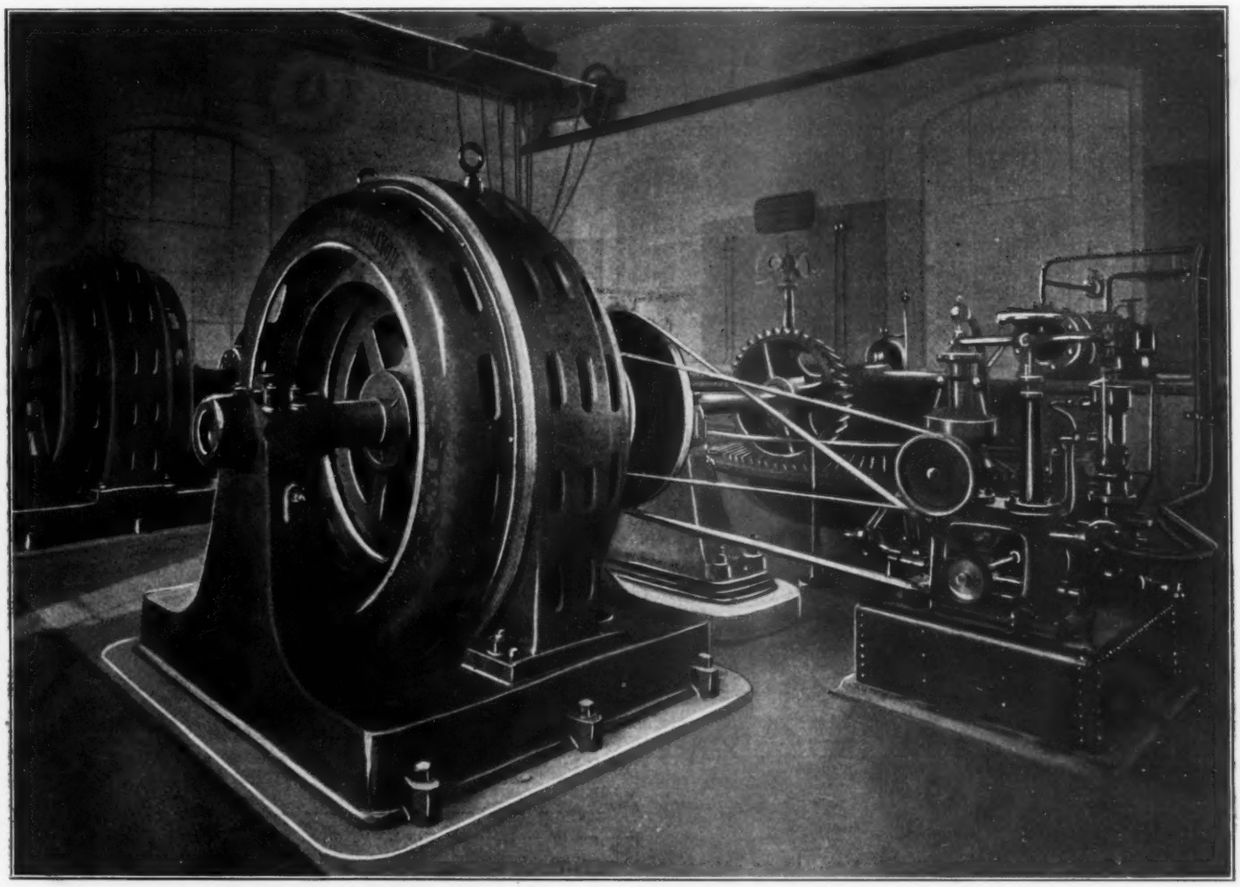


FIG. 6.—MACHINE ROOM OF BLATTEN POWER STATION.

The power house itself is a spacious, well-ventilated brick building on concrete foundations. The roof is of iron, covered with flat tiles. An 8-ton traveling crane facilitates any erecting or repair of machinery that may be necessary. A small workshop with several machine tools driven by a three-phase, 6-hp induction motor is attached to the power-house. The building is lighted by incandescent and arc lamps.

The current is conducted from the generators to the switches by means of bare copper lines supported on ribbed insulators. The exciting, direct-current lines are insulated and carried on porcelain rollers. A special trough in the floor, covered with ribbed plates, contains all these connecting lines.

The auxiliary apparatus is placed in three rooms, one above the other, which are separated from the machine room by a wall supporting the main switchboard. The latter is divided into five panels (Fig. 4). Each generator has a separate panel with a main and an exciting current ammeter, a hand wheel for the voltage regulation and a lever-switch. All three panels

single-phase, 1.5-kv-amp, 10,000/150 volts transformer which supplies the buildings with energy for lamps, and a three-phase, 6-kv-amp, 10,000/260 volts transformer with primary fuses feeding the workshop motor. The other two compartments each contain two series transformers and an oil switch with an automatic release system in case of short circuits in the lines.

NON-SYNCHRONOUS GENERATOR STATIONS.

The Lienz and Blatten (Fig. 5) stations, like the central power station, are brick buildings on concrete foundations. They are equipped identically and each contains two 250-hp hydro-electrical sets (Fig. 6). The turbines and their couplings to the generators are the same as in the Montlingen station; but no governors are in service here. The generators are of the non-synchronous type running above synchronous speed; that is, over 250 r.p.m. Their principal dimensions are: External diameter of stator, 1930 mm; internal diameter of stator, 1560 mm; core width of armature, 220 mm. The stator

has 216 slots (16 x 56 mm) with 62 conductors in each. The stampings are 0.3 mm thick. Fig. 7 shows the test results of these machines.

Owing to the nature and properties of these generators the amount of auxiliary apparatus necessary is comparatively small. The main switchboard is conspicuously simple (Fig. 8). It contains the circuit breakers, the main current ammeters, a busbar voltmeter and a three-phase supply meter. The auxiliary

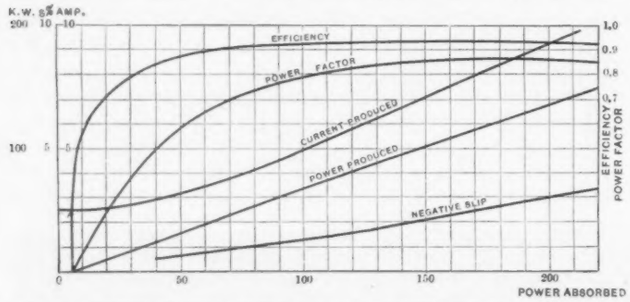


FIG. 7.—CURVES OF TEST RESULTS OF NON-SYNCHRONOUS GENERATORS.

apparatus is placed in two rooms, one above the other and divided into compartments, as at Montlingen.

TRANSMISSION LINES.

As already mentioned, the Montlingen synchronous power station is supplied with energy from the other two stations and all the energy is distributed from here by means of a ring main. The feeders join the Montlingen central station to the Alstätten substation, this substation to the Heerbrugg switch-station and this switch-station to the central station. Each half of the ring main has a busbar in the Heerbrugg switch-station; these busbars can be connected with each other by means of a switch so that the ring can be completed at any moment. In case of disturbance one of the lines can thus be used to carry energy for the other. When the system is working normally, however, the ring is open.

Oil switches enclosed in cast-iron boxes are placed in the line outside all villages traversed by it. These switches can be thrown out by means of a hand lever and drawrod (Fig. 9).

Wooden poles up to 16 m long with concrete foundations are used for all the lines. Between the power stations, the lines are of 6 mm diameter copper wire, all others being 3 mm in diameter.

SUBSTATIONS.

The principal substation is that at Altstätten. It contains

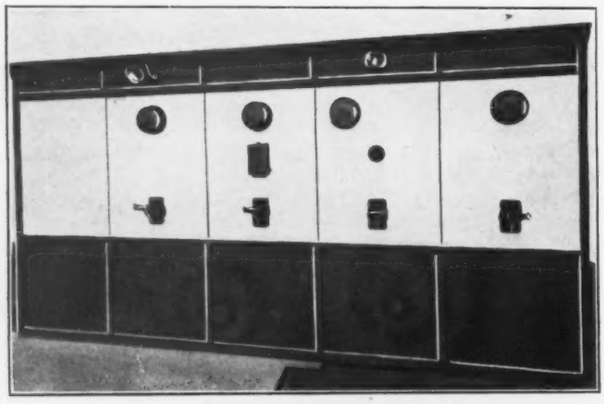


FIG. 8.—SWITCHBOARD OF BLATTEN POWER STATION.

four 100-kv-amp, 10,000/2000-volt transformers with the necessary switches, fuses, lightning arresters and measuring instruments. The station is constructed of masonry. On the ground floor are the transformers and ammeters; on the first the oil switches and fuses, and on the second the lightning arresters with their carbon resistances and the choke coils. The connections to the outside 10,000 and 2000-volt lines are also made on the second floor.

From here the 2000-volt current is distributed to seven transformer stations, some of which are small masonry buildings and others iron lattice towers (Fig. 10). Each of these towers contains at its base a 38-kv-amp, 2000/2000-volt transformer, on the primary side of which are high-tension fuses and lightning arresters and on the secondary side fuses and lightning arresters with an ammeter and voltage cut-outs. The two sets of apparatus, the one on the primary side and the other on the secondary side, are kept entirely separate from one another, being made accessible by doors on opposite sides of the towers. The voltage cut-outs consist of two bars with a sheet of insulating material between them. The insulation will break down when the voltage rises above a certain value and so protect the secondary lines from any dangerous high voltage which may occur when, for instance, contact is made between the primary and secondary windings of the transformer.

In the small masonry substations the transformers are placed on a level with the ground and all high-tension apparatus is in

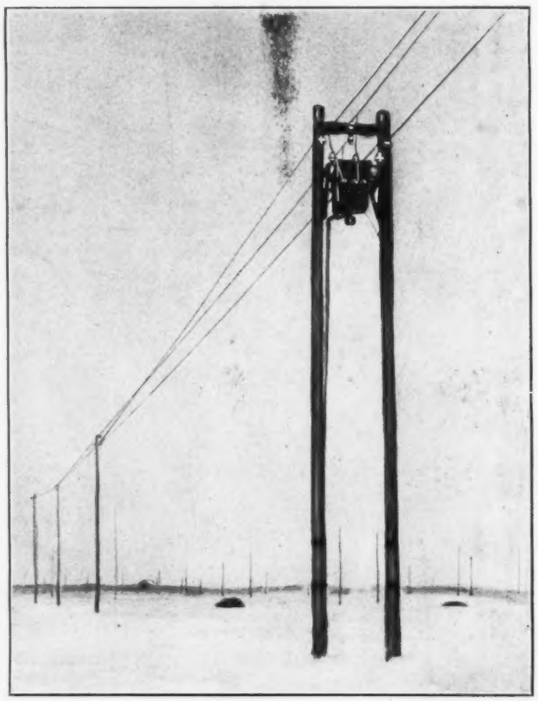


FIG. 9.—EMERGENCY POLE SWITCH.

a chamber above. Special openings are provided for the leading in and out of the high- and low-tension lines.

The Heerbrugg switch station contains all the necessary instruments connected with the two above-mentioned busbars, in order that the load on each half of the ring main may be ascertained at any moment. This station is further equipped with two 100-kv-amp, 10,000/230-volt transformers.

DISTRIBUTING SYSTEM.

Energy is distributed at 220 volts. As there are no separate lines for the light supply, the three-wire system was adopted. The current at 220 volts is principally supplied to a great number of small induction motors driving embroidery machines, which are extensively used in this district. The wattless current necessary for such motors being comparatively great, the power factor of the whole network is affected. In fact, this power factor varies between 0.65 and 0.85. There are, in addition, special high-tension lines which feed a motor-generator set, producing the direct-current necessary for the Altstätten-Berneck electric railways.

The plants described above have been in regular operation since January, 1906, and have fulfilled all expectations. So far as the writer knows, they are the only plants in Europe in which such a wide use is made of induction generators.

PRACTICAL OBSERVATIONS.

In running the induction generators in parallel the turbine is brought to the synchronous speed of 75 r.p.m. (250 r.p.m. for the generator) and the generator is switched on to the busbars. More water is then admitted to the turbine. In practice, parallel operation has never given any trouble.

At the moment of switching a sudden rush of current is observed; this is, however, not strong enough to have any dangerous mechanical action on the generators or to produce any fluctuation of voltage in the network. The occurrence of such rushes is only indicated by a sudden oscillation of the switchboard ammeter. It is a well-known fact that the switching in of all transformers and induction motors produces current rushes, even if, in the case of induction motors, they have already reached their synchronous speed.

During special experiments it was noticed that the induction generators have a certain damping action on the wave form of the e.m.f. Although possible, it rarely happens that the power of the network is lower than that produced by the induction, or non-synchronous, generators. In this case, as the turbines of the latter have no governors in service, an acceleration of their speed followed by a corresponding acceleration of the synchronous machines takes place. By diminishing the water admission of the turbines in one of the Lienz or Blatten stations, normal conditions are again quickly attained. This phenomenon can be easily explained.

Taking in consideration the properties of induction generators and the conditions under which they are employed in this case, the power distribution in the system itself can be roughly represented by the following simple equation:

$$n + x = y \text{ or } x = y - n$$

where y = the load in kilowatts on the network; x = the power furnished by the synchronous generators, and n = power furnished by the induction generators. n is constant and, therefore, independent of y; it depends only upon the number of induction or non-synchronous generators in service and the water admission of their turbines. As the equation must always be satisfied, it follows that all changes of y will be counterbalanced by corresponding changes of x and of x alone; that is, the synchronous station absorbs all the variations of the load and does all the power-regulating work.

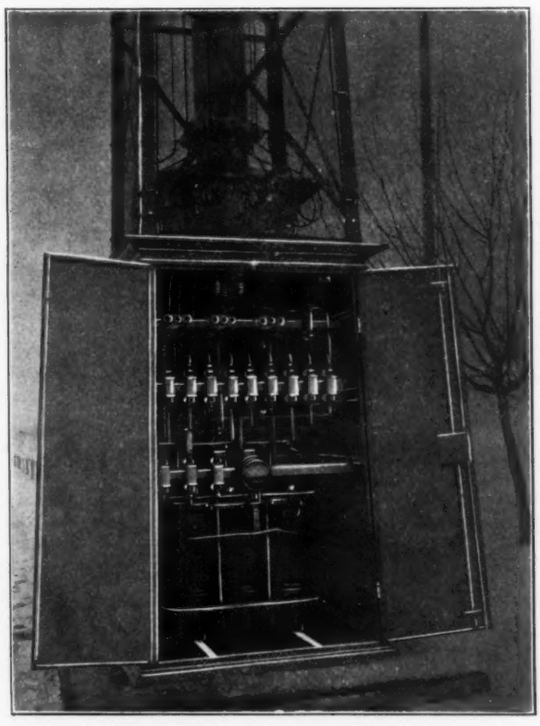


FIG. 10.—BASE OF IRON TRANSFORMER STATION.

The relation $y = n$ or $x = o$ defines the limit of stability of the whole system.

When y is less than n, x is negative; that is, the synchronous generators will run as motors driving their turbine wheels (the governors having closed the water admission) and absorb the power x. If x is greater than the power necessary to drive the turbine wheels at synchronous speed under these conditions, the speed, both of the non-synchonous and of the synchronous machines, must increase until the resulting extra losses equalize the excess of power $(n - y)$ produced by the non-synchronous generators.

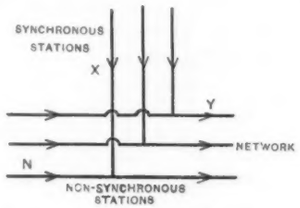


FIG. 11.—DIAGRAM OF CONNECTIONS.

It is clear that in this case, if the admission of the turbines in the non-synchronous stations is diminished until $n - y$ is less than o or n is less than y, the acceleration will be prevented. A practical confirmation of this conclusion has been already obtained in the described plants.

Among the numerous cases in which non-synchronous generators can be advantageously applied may be specially mentioned the utilization of the exhaust steam of non-condensing steam engines. In a plant of this kind consisting of a central station equipped with non-condensing steam engines two Oerlikon-Rateau turbines, directly coupled to non-synchronous generators of 1100-kw output each and fed by the exhaust steam, have been installed by the Oerlikon Works. The turbines have no governors and the generators will utilize the whole power available without any danger of racing. The plant has been running with this equipment for the last few months and has given complete satisfaction.

The determination of the power distribution and regulation in this case is more complicated than in such cases as the above-described water plants, since there is a close relation between the power supplied by the steam engines and their exhaust steam which must be taken into consideration. The power produced by the induction generators is not independent of that produced by the synchronous generators.

A New Source of Illumination.

BY G. A. JOHNSTONE.

Aluminum electrodes in a cell used as a condenser, rectifier or lightning arrester are known to show small sparks scattered over the surface of the metal when the voltage exceeds a certain amount. While experimenting with cells for the above purposes the writer discovered that some aluminum alloys became very brightly illuminated under certain conditions. It is the object of this article to give a short description of the phenomenon and an application that has been made.

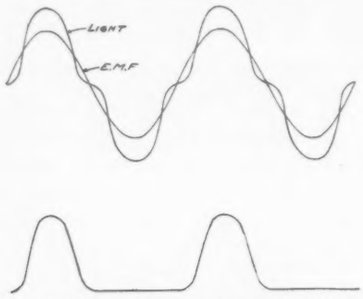
With pure aluminum electrodes the sparking does not occur until comparatively high voltage is applied, the value depending on the history of the cell, and the nature and temperature of the electrolyte. The sparks are very small and of short duration, but very white and bright and appear scattered over the whole surface of the metal.

The explanation given is that at the high voltage certain weak points in the film break down, a minute arc forms and immediately the spot heals over and breaks the arc. If the voltage is maintained, unless it is too near the critical e.m.f. of the cell, the weak spots will become strengthened and the sparking will gradually become less until the voltage is again raised; sparks then appear until the film again thickens by a sufficient amount to prevent their formation at the new voltage. One writer has

described this phenomenon to resemble the heavens on a clear starlight night.

It was thought that the weak spots in the film were probably caused by foreign substances at the surface of the metal, and that if an alloy were used the sparking would be more permanent. The results of a trial of one combination in particular were so striking that they promised at once possibilities of usefulness. Moreover, an entirely new phenomenon was presented that, although closely allied to the sparking described above, could better be compared to the face of a very bright full moon than the starlit area of the heavens.

This alloy was one that is used in making small aluminum castings. It consists of about 90 per cent aluminum and the remainder mainly of copper and tin, with small quantities of manganese, iron and zinc and traces of silicon. With such a large percentage of foreign non-film-forming metals present, the

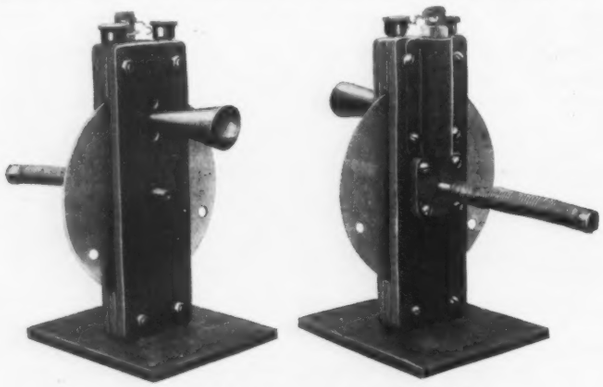


FIGS. 1 AND 2.—CURVES OF LIGHT WAVES.

alloy would hardly be expected to resist a very great voltage. It was found, however, that although the leakage was much greater than with pure aluminum, the pressure could be gradually raised to 250 volts without the passage of large currents.

The electrolyte used most frequently was a solution of common laundry borax. Other alkaline solutions gave similar results.

As intimated above, the light from this cell is very different from that of one using pure aluminum. Instead of being described as sparking it can best be called glowing. With a cell that has been subjected to voltage for a sufficient time to form a considerable coating on the electrodes, the glowing is first noticeable at a pressure of from 40 to 50 volts in a room where the daylight is shaded, and increases in brightness with the e.m.f. until at 200 volts a stick looks like a white-hot iron rod that has just been plunged into water. With the lower voltage the light is of an opal color and presents an appearance very similar in evenness and brightness to a white tower closely studded with incandescent lamps when viewed at sufficient distance through the darkness to make the individual lamps in-

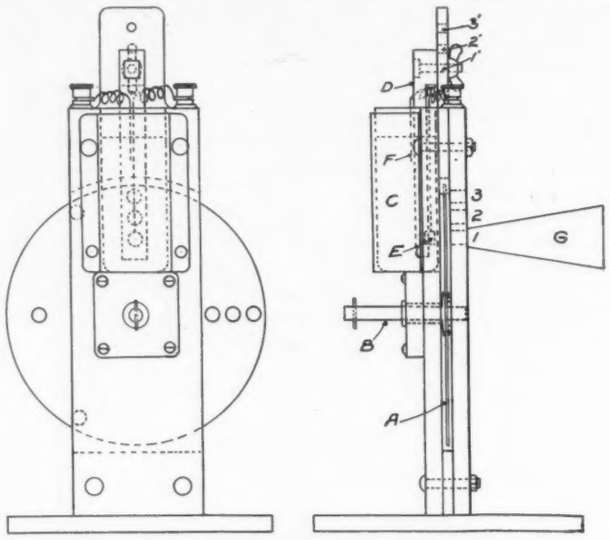


FIGS. 3 AND 4.—VIEWS OF SLIP METER.

distinguishable. When the e.m.f. is increased beyond 200 volts, small white, shifting sparks appear among the glow, which itself has become white.

The performance of the cell is parallel, if not similar, to that of a highly charged transmission line. The glowing of the electrodes may be likened to the corona which forms about the wire when the potential is sufficiently high, while the sparking takes the place of the breakdown between wires. In one case the dielectric is air and in the other a film of oxide microscopically thin.

The explanation, however, that seems most suitable is that the light emanates from a multitude of minute arcs that form at



FIGS. 5 AND 6.—DETAILS OF SLIP METER.

each point where the foreign substances appear. When viewed with a microscope the illumination does not separate into individual arcs, but this is as would be expected on account of the gas bubbles that are continually forming and shifting on the surface of the metal; moreover, the non-film-forming substances must be separated by molecular distances only. Of course, it is rather hard to conceive of an arc being struck from a single molecule of copper or tin, or iron, but at the present time this explanation seems best to describe the action. Further research with the proper equipment may determine that the gases present play an important part.

Later, pure aluminum sheet, or the so-called pure (about 99.5 per cent), when tried in a dark room was found to show some glowing that had entirely escaped detection in the lighted room, and here the distinction between the glowing and the sparking was very marked indeed. When the e.m.f. (100 volts, say) was suddenly applied to new electrodes of this pure metal, a very faint bluish-white glow appeared at once, but gradually disappeared in a minute or so, and there was no more light to be seen unless the e.m.f. was raised to the sparking stage, perhaps another 100 volts being required.

The performance of the alloy and the pure metal is, therefore, very similar, the only difference being in the time of the appearance and the duration of the two stages. The alloy does not glow until some minutes after the e.m.f. is applied—that is, until the film has formed to some degree—and it persists for an indefinite period as compared to the pure metal, and the two stages are merged. This delay of the glowing in the case of the alloy is to be expected, since the foreign materials in the surface give short-circuit points between the electrode and the liquid until the formation of oxide over the points where aluminum molecules are present gradually obtains sufficient thickness and area to crowd the connecting links between the conductors into such long, narrow quarters that the passage of the leakage current through each one is accompanied by a minute arc.

The film may be considered as a non-conducting honeycombed sheet that is interposed at the beginning of every other half cycle between the electrode on the one side and the liquid on the other, the openings registering with the molecules of foreign substances, and thus drawing the arcs.

Since these small arcs, if we can so call them, are fed by the foreign metals present, they being the positive element, it would be expected that the spectrum of the light would indicate what

metals are present. Probably absolutely pure aluminum would show no glow.

Some further idea of the intensity of the light from this source can be gained from the fact that a very good view of the spectrum is obtained with even a common small spectroscope. A cell using two sticks the size of an ordinary lead pencil gives sufficient light to read small print when held near the glass containing vessel but at arm's length, the power consumption being only 8 or 10 watts.

The glowing is the same to the unaided eye with alternating current as with direct current, except that with the former both electrodes are illuminated, while with direct current only one becomes luminous. This is the anode, the one at which the voltage is consumed. The dark electrode can be any other metal, such as lead or iron.

With alternating current the voltage will be consumed alternately at the two electrodes, both having assymmetric properties. That is, during one-half cycle the voltage, and consequently the

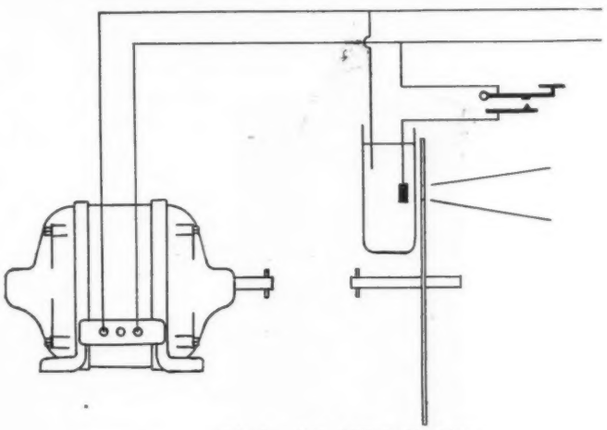


FIG. 7.—SLIP METER IN USE.

light, will be at only one electrode and for the next half cycle at the other, each electrode going through a period of light and one of darkness during each cycle. This fact is demonstrated when a cell having its two electrodes near each other is viewed with a stroboscopic disk. The light appears first at one and then at the other in the same way that the arc in a mercury rectifier is seen by means of a disk to leave one anode and appear at the other, only the light is less abrupt in changing from one source to the other in the aluminum cell.

The wave of illumination may be illustrated as in Fig. 1, it being assumed to be in time-phase with the e.m.f. The part of the curves above the line represents the value of light and voltage at one electrode, and that below the line those at the other. If one of these be screened from view, the light wave will be as in Fig. 2; it will have one-half the periodicity of the arc lamp. The use of this phenomenon in a speed-counting device is at once suggested.

In Figs. 3 and 4 there is shown a slip meter that was used by the writer with very gratifying results in connection with induction motors. Its construction will be plain from Figs. 5 and 6, which show a slight modification in the mechanical arrangement from that in Figs. 3 and 4.

At *A* is a disk driven by the shaft *B*, which is connected by flexible coupling to the shaft of the motor under test. Small holes in the disk are arranged in three circles of different radii, there being only one hole in the first or inner circle, two in the second, and three in the third. In the frame at 1, 2 and 3 is a row of peep holes spaced so as to register with the circumferences of the three circles on the disk and through which the holes in it may be viewed as they come around. At *C* is the cell. A holder *D* introduces the terminals *E* and *F* into the liquid and it may be secured at 1′, 2′ or 3′ at will, thus putting the terminal *E* in line with the peep holes 1, 2 or 3, respectively. *E* is a button of the alloy which is connected to the circuit by a small wire of pure aluminum. The other electrode *F* is merely a piece of the same wire dipping for a short distance into the electrolyte. This is all that is necessary, as no light is required at *F*, and the pure metal will keep down the current during the half cycle that *F* is anode. A cone *G* aids in viewing the button *E*. The connections to the circuit are shown in Fig. 5. A contact switch is provided to put the cell in circuit only when in use, to prevent heating as much as possible.

The operation of the device can best be understood by taking an example. Suppose the meter is connected to a two-pole, 60-cycle motor. The proper position of the button *E* is as in the drawing; that is, opposite the circle with only one hole. It will be illuminated 60 times a second and the single hole in the disk will give nearly 60 views of it to an observer, the number depending on the slip of the motor. The number of times the button is seen to light up in a given time will, therefore, be the number of revolutions that the disk or motor has slipped from the synchronous speed in that time.

With a four-pole machine this condition of affairs is exactly imitated if the circle with two holes is used. The set of three holes is for use with a six-pole machine and for a larger number of poles more holes could be provided. The additional holes with the slower machines give a stronger view of the electrode *E*, although the single hole would answer the purpose equally as well as far as obtaining the correct slip is concerned.

The model shown in Figs. 3 and 4 has a disk 5 in. in diameter with ¼-in. openings. The cell is contained in a ½-in. test tube which has the top cut off. The button is about one-half the size of the end of a lead pencil. Even with this small model good results are obtained, the coming and going of the light being so clear and distinct that very high slips can be got, the only limit being the maximum rapidity with which the observer can count distinct and clearly separated images. Slips as high as 200 r.p.m. are had with great ease and accuracy, and, of course, the smaller the slip the easier it is to count.

The simplicity, both in construction and operation, of this instrument and also its great accuracy and wide range of limits should recommend it very highly. The phenomenon employed is certainly very interesting and promises reward for further and more elaborate research.

Aluminum-Cell Lightning Arresters.

BY E. E. F. CREIGHTON.

A previous article discussed briefly certain features of lightning phenomena, and mention was made of continual surges. The present article deals with the aluminum cell arrester, which is the only known device for protecting against continual surges.

The conditions to be met being so variable, several types of aluminum arresters have been designed. In all of these arresters the aluminum cell is the basis of design, and consequently they have certain common characteristics. The characteristics of the aluminum cell will be described, and subsequently some of the variations in the design of the arrester to meet the demand of practice.

The useful characteristic of the aluminum cell is its critical voltage. This critical voltage depends upon the formation of an hydroxide film of aluminum on the surface of the aluminum plates. The plates are put through chemical and electrochemical treatments until this film is formed. After this, the plate, dipped in a suitable electrolyte, has a characteristic of taking exceedingly low currents up to its critical voltage, but when the e.m.f. is above critical value the current is limited only by the internal resistance of the electrolyte. The closest analogy to this action is found in the well-known safety valve of the steam boiler, in which the steam is held back until the pressure rises to a certain value, and is then released for all excess pressures. On the aluminum plate there are myriads of these safety valves, so that if the electric pressure rises above the critical voltage, the discharge takes place equally over the entire surface. This phenomenon is visible to the naked eye.

The volt-ampere-characteristic curve of the aluminum cell varies somewhat according to whether direct currents or alter-

nating currents are used. If direct current is used there will be no current through the circuit except the tiny leakage current through the film; whereas, if alternating current is used the aluminum cell acts as a fairly good condenser, and there is not only the leakage through the film, but also a heavy capacity current flowing into the cell. The time-phase of this current, then, is nearly 90 deg. ahead of the potential and represents a very low power factor. A volt-ampere-characteristic curve of the aluminum cell on direct current is made up of two straight lines, or, otherwise expressed, the leakage current per volt impressed up to a maximum of 420 volts is about 0.000003 amp; above 420 volts, the current is approximately 2 amp per volt increase; 420 volts is the usual *permanent* critical voltage. This voltage will vary considerably with the nature of the electrolyte.

Since the arrester will discharge high values of generator current for a brief interval, there is no doubt that it will take lightning discharges which are of less duration. In all of the designs, the number of cells for the circuit are chosen so that the average generator e.m.f. per cell is always less than 420 volts, the permanent critical voltage.

Another characteristic of the aluminum cell is the dissolution of a part of this film when the plates stand in the electrolyte and the cell is disconnected from the circuit. The film is composed of two parts; one part is hard and insoluble and apparently acts as a skeleton to hold the more soluble part. The facts connected with the action of the cell seem to indicate that the soluble part of the film is composed of gases in the liquid form. The dissolution of the film varies greatly with the nature of the electrolyte. When a cell, which has stood for some time disconnected, is reconnected to the circuit, there is a momentary rush of current which replaces the part of the film which is dissolved. In suitable electrolytes the duration of this current rush will be less than 0.01 second even after the cell has stood for over a week. The current-rush will have increasing values as the interval of rest of the cell is made greater. Dozens of electrolytes have been studied, and there has been no electrolyte found which does not show this dissolution effect to a greater or less extent. The disadvantageous conditions produced by these current rushes are usually negligible. If the cell has stood disconnected from the circuit for several weeks, there is a possibility that the initial current rush will trip an instantaneous relay of a circuit-breaker. This current rush also raises the temperature of the cell. This initial effect is avoided by connecting the cells to the circuit every day or two.

When a cell is connected permanently to the circuit, there are two conditions, which may be distinguished as *temporary critical voltage* and *permanent critical voltage*. For example, if the cell has 300 volts applied to it constantly, and the voltage is suddenly increased to, say, 325 volts, there will be momentarily a considerable current rush until the film thickness has been increased to withstand the extra 25 volts. This action will take place at all e.m.fs. up to the permanent critical value, which is about 420 volts. Above 420 volts the film cannot thicken appreciably. If the voltage is again reduced to 300, the excess thickness of film will be gradually redissolved. If the voltage is varying periodically between two values, each of which is less than the permanent critical value, the temporary critical voltage will be the upper value. This characteristic of the cell is extremely valuable; it provides a means of discharging abnormal surges the instant that the pressure rises above the normal impressed value. In comparison, other arresters usually require 100 per cent or more rise in potential before the current begins to discharge.

LIFE OF THE ARRESTER.

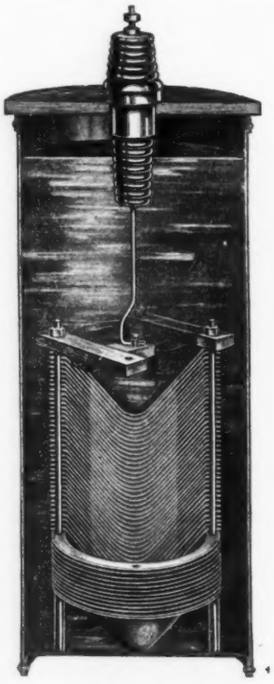
If the arrester is connected to the circuit continually there is a constant wear on the surface of the aluminum, and it is necessary to replace the aluminum plates from time to time. If, however, a gap is used in series, and the arrester brought into operation only at times of high abnormal voltages, there is no appreciable wear on the plates.

CHOICE OF DESIGNS.

To meet the usual conditions of transmission circuits, three main types of aluminum arresters have been designed. (1) The gap aluminum arrester, cone type. (2) the no-gap direct-current aluminum arrester. (3) The surge protector, the alternating-current no-gap type.

The gap aluminum arresters have been designed for the protection of overhead constant potential alternating-current systems of all e.m.fs. from 2300 to 110,000 volts. This arrester consists of inverted concentric cones slightly separated and partially filled with a suitable electrolyte. The stack of the cones is then immersed in oil contained in an iron tank; the lowest cone is connected to the iron tank, and the upper cone is connected through a horn-gap to one phase of the transmission line, as shown in the accompanying illustration.

The two variable factors which can be adjusted by an operator to meet the local conditions are, first, the gap setting, and, second, the nature and quantity of the electrolyte. This arrester is designed primarily to discharge continual surges for one-half hour or more. The total duration of discharge which can be withstood will depend on the initial temperature of the arrester, since the limitation is set by the final temperature.



ALUMINUM-CELL LIGHTNING ARRESTER.

Since the aluminum arrester is the only one designed for continual surges, its series horn-gaps should be set at values less than the spark value of the other arrester on the circuit designed for transitory lightning, so that it will protect the other arresters from destruction. For this kind of a disturbance, then, the aluminum arrester becomes a protector for the other arresters, and completes the protection of the system. How many aluminum arresters are necessary to do this work depends on the size of the system, the voltage, the tendency to resonance on the circuit, and the severity of the arcing ground. The minimum number may be one.

As a further consideration, since the time of discharge of the arrester is limited, it is necessary that an attendant shall be advised as soon as the arrester commences to discharge, so that he can take precaution to remove the trouble. Where the arrester is installed in plain view and in hearing of the attendant, its operation will make itself known to him immediately; if, however, the arrester is installed outdoors or in an adjacent room, it is essential to use a lightning alarm in connection with the arrester. This lightning alarm consists essentially of two parts; an extra aluminum cell installed in the ar-

rester circuit next to the earth, from which leads are run to an alarm bell, placed at any convenient place in the office or station.

The endurance of arresters to continuous discharge is somewhat indefinite since, as already stated, it depends on the initial condition of the arrester and the initial room temperature. Some idea of this endurance may be formed from life tests that were made on a 13,000-volt cone-type arrester. The gap on this arrester was set below the spark potential of the circuit, and the arrester allowed to discharge in relays of *two* or *three* hours twice a day until the total length of discharge was 80 hours. At the end of that time the arrester was still operating normally. The cones were disassembled, and were all found to be somewhat worn by the passage of the current, but still in useable condition. It is estimated, however, that it would require many years to sum up a total of 80 hours of continual surges on any circuit under normal operating condition.

The above facts suggest the question of what will take place if the arrester is left to discharge continuously on the circuit. It is recommended that the arrester may be allowed to discharge for half an hour without causing any serious trouble. If the operator should care to run the risk of allowing his arrester to discharge for a longer time, he may do so under certain circumstances; the action of the arrester will then be as follows:

The continuous passage of the current will continue to heat the electrolyte and oil, but the current will increase only slightly until a certain critical temperature is reached; then the current will increase quickly from about 1 amp normal discharge rate to the destructive value. If a fuse is placed in series of a size large enough to take all known forms of induced lightning and recurrent surges, but small enough to disconnect the lightning arrester from the circuit in time to prevent permanent damage to the arrester, an interruption of service from a failure will be avoided, and the arrester may be put into serviceable condition again after it cools. The discharge rate of the arrester at double normal voltage is of the order of 1000 amp. and the leakage current at normal voltage is less than 1 amp.

LINE, OR UNATTENDED, ARRESTERS.

When an aluminum arrester is located either on the line or in the station where there are no attendants, it is evidently undesirable to have the arresters discharge continually unbeknown to anyone. If the arrester does this it will discharge until it is disconnected from the circuit by its series fuse. The first condition, then, in the installation of the arresters in this location is to increase the length of the horn-gap to such a value that if continual surges occur on the line they will not discharge except for very abnormal peak values, and the lesser surges will be carried to the station arresters where the discharge will be observed and precautions taken to remove the trouble. Since the arrester is to be used more or less in an intermittent capacity, and may not be inspected conveniently every day, the electrolyte is changed. An electrolyte is chosen which gives less dissolution of the film, so that it may be allowed to stand for a long interval without connection to the circuit and still not cause an inconveniently large initial current rush. In making this change, the discharge rate of the arrester is not diminished, in fact, it may even be increased if desired; the endurance to long discharge, however, is lessened. In all situations inspection is normally made at least once a week; consequently it is recommended that the line arrester be connected to the circuit once every week.

The value of oil in the arrester as an absorber of heat may be judged by the following test: Two 2300-volt arresters, having equal internal resistance, were set up. One was filled by allowing the electrolyte to overflow from the upper cone to the lower one, and a small amount of oil was then placed on top; the other was partially filled and immersed in a tank of oil. The arrester that was not immersed in oil operated 15 minutes and then blew its fuse. The other arrester immersed in oil operated two days continuously and did not blow its fuse at the end of that time. In other words, for this low voltage the surface of radiation was sufficient to keep the arrester within reasonable temperature limits. Since for higher voltages it is impossible to proportionally increase the radiating surface with the potential, this condition of radiation will not hold, and it is necessary to depend more and more on the heat storage capacity of the oil. While an aluminum arrester not immersed in oil serves very well for transitory lightning, it is not at all suited for taking care of continual surges.

HORN-GAP SWITCHES.

On account of the desirability of connecting arresters to the line from time to time, the horn-gaps take new forms. The horn-gap is arranged to fulfill three functions: (1) As a horn-gap, to prevent line voltage from reaching the arrester. (2) As a short-circuiting switch, so that the operator may safely and easily connect the arrester to the line when desired. (3) As a disconnecting switch to isolate the arrester from the line when desired.

ALUMINUM ARRESTERS FOR DIRECT CURRENT.

The arresters for direct current have to meet more favorable conditions of internal loss, but more difficult conditions of delicate insulation to be protected than do the alternating-current arresters.

The usual direct-current circuit has a potential of 600 volts and the insulation is usually double-cotton covered wire; yet the motors carrying this delicate insulation are run out in the suburban districts where the inductive disturbance from thunder clouds is as severe as found on a high-tension circuit. To meet this condition the series-gap of the arrester is abandoned and the aluminum cells are connected directly between the line and ground. A value of plate area is chosen which will discharge over 1000 amp of current at double e.m.f. (1200 volts). Some idea of the comparative value of this arrester is obtained from the current discharge rate relative to the arresters in present use. One of these arresters discharges 17 amp and the other about 0.3 amp of generator current at double normal voltage. The leakage current through the aluminum arrester is never over a few milliamperes and is usually only 1 milliampere. Thus the increase of current from normal potential to double normal potential is a million fold. The equivalent needle-gap of this arrester is 0.00 in. as compared to 0.25 in. for the older types of 600-volt arresters. The internal resistance is so low, and the inductive circuit so short, that the hands can be held across this arrester while a discharge of 100,000 volts at a frequency of about 1,000,000 cycles from the leyden jars is being sent through it. In this type of arrester the effect of the temporary critical film voltage is prominent; it may be said that the arrester begins to discharge the instant the e.m.f. rises 1 volt above normal. The capacity of this arrester as measured by the ordinary methods is equal to the electrostatic capacity of 400 miles of trolley. The capacity is a combination of the electrochemical and electrostatic.

SURGE PROTECTOR.

The third general type of aluminum arrester is the surge protector. The surge protector, like the direct-current arrester, is connected directly to the circuit. The principal problem relates to the wear of the aluminum plates under the continuous scouring action of the alternating currents. The cone type of the arresters has been tested in service during several years, but the surge protector is more recent, and is now being tested in service. The necessity for the surge protector is found principally on cable systems where the ratio of the capacity to the inductance is large, and consequently, where the surge current on the line will be correspondingly large for every volt of lightning potential. Before this article comes from the press tests under abnormal conditions of the instantaneous valves of surge potential and surge current on a large cable system using a standard form of surge protector will have been completed. This material will be published subsequently.

CHOICE, CONDITION AND LOCATION OF ARRESTERS.

In the preceding discussion an attempt is made to show briefly the variable demands on an arrester. Although no in-

variable rules can be made to include all cases, it is possible to cover most of them with the following directions:

On overhead systems use enough gap aluminum arresters to protect the entire system from an accidental grounded wire. Use these aluminum arresters in stations where there is an attendant, or where an auxiliary small wire may connect to an alarm in a house or office from which word can be sent to the nearest station that trouble exists on the line. In all such locations use normal electrolyte and a horn-gap setting of from 125 to 175 per cent of normal potential, according to the local conditions. In general, use the aluminum arrester where there is expensive apparatus. Move other types of arresters from important stations to places of less importance to give room for the aluminum arresters. Keep the aluminum arrester as cool as possible. Except in very sunny, hot countries, no unusual precautions need be taken.

In unattended stations or isolated installations use modified electrolyte if tests cannot be made more frequently than once per week, and make the horn-gap setting correspond to from 175 to 225 per cent of normal voltage. Use this type of installation where overhead lines join cables.

For direct-current railway circuits, the aluminum arrester becomes essential in suburban districts where lightning is frequent. On every direct-current feeder circuit use aluminum arresters in the stations, at least. Use aluminum arresters in any location where the resistance type is not giving complete protection. For complete protection of a system the established rule should be followed of placing one arrester on each car and two per mile on the line.

On 110-volt direct-current circuits use the no-gap 300-volt aluminum arrester to protect watt-hour meters, recording meters and other delicate apparatus.

How to Work a Patent in England.

By an English Barrister-at-Law.

Numerous reports which have lately appeared in the English papers make it apparent that persons foreign to England who hold English letters patent are beginning to be nervous about the effect of the recent change in English patent law. Although the present government in England is pledged to free trade, they have made a signal departure from this doctrine in relation to the letters patent law. The policy of the patent act of 1907 is to prevent a foreigner, such, for instance, as an American or a German, acquiring an English patent and working it exclusively or mainly outside England.

Inasmuch as the law in question comes into force on Aug. 28 next, it is high time for the American who holds patents in England to take steps to comply with it. Otherwise he may find himself in an awkward predicament.

With a view to enabling those of your readers who own English patents to ascertain their true position according to English law, it is proposed to explain the nature of the change which has been introduced and the methods by which the American holder of an English patent can protect himself. Under the second head will be described the various methods to which holders of English patents may legally have recourse to transfer their rights to, or share them with, other persons.

Nature of the Recent Changes in English Law.

Prior to 1906 any man was at liberty to take out an English patent and refuse to work it in England. He could then (and can still, up to Aug. 28, 1908) prevent the patented article being made on English soil. Statistics show that in the year 1906, out of 14,700 patents issued, 6500 were granted to foreigners, while in the case of patents for dyes, the proportion was about 95 per cent. In many cases these inventions were worked abroad exclusively, and the patented articles, or substances made by the patented processes, were imported in large quantities into England, the British patents being used merely for the purpose of closing the market to persons other than the patentee or his licensees.

It should be mentioned that the charge of taking out and "sitting on" English patents was not levied at the American, but at the German manufacturers. By adopting these tactics the production of aniline dyes under English patents has practically been transferred to German soil.

The government of the day in England has now sought to put a stop to all this. By section 27 of the act, at any time not less than four years after the date of a patent and after Aug. 28, 1908, any person may apply to the comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. The comptroller must consider the application, and if after inquiry he is satisfied that the allegations contained therein are correct, then, subject to the provisions of the section, and unless the patentee proves that the patented article or process is manufactured or carried on to an adequate extent in the United Kingdom or gives satisfactory reasons why the article or process is not so manufactured or carried on, the comptroller may make an order revoking the patent either (a) forthwith; or (b) after such reasonable interval as may be specified in the order, unless in the meantime it is shown to his satisfaction that the patented article or process is manufactured or carried on within the United Kingdom to an adequate extent. No such order can, however, be made if it is at variance with any treaty, convention, arrangement, or engagement with any foreign country or British possession. The comptroller has power to extend the period mentioned in his order if the patentee gives satisfactory reasons why his patent is not manufactured or carried on.

How to Avoid the Above Provisions.

It is obvious that any American patentee who has hitherto been unable or unwilling to work a patent in England must shortly take steps to do so, unless he is prepared to run the risk of forfeiture.

What measures can he adopt? He can build a factory in England if he is wealthy; but to embark upon great capital expenditure may not be worth his while, if the patent has only a few years to run. There are, however, certain other courses open to him. He may grant licenses or assign away his rights in the United Kingdom, and it is with the object of explaining how transactions of this kind may be carried out in accordance with English law that the present article is written.

In a recent American work entitled *Inventions*, by Frederick B. Wright, of New York, the author says: "It is surprising how entirely careless inventors and owners of patent rights are with regard to contracts, sales and other transfers. In entering into a contract or any other subject, the services of an attorney are sought and the conditions of the contract are fully set forth . . . but when a share in an invention is bought, however, or some right under a patent acquired, the parties seem to leave their wits and common sense at home." If the inventor is liable to the pitfalls of American law he is far more likely to be enmeshed by English jurisprudence.

A patentee may dispose of his rights in England by (i) assignment or (ii) license. A license may be (a) general; (b) exclusive; or (c) restricted.

Assignment of Rights.

A patent in England can only be assigned by deed; that is to say, by a formal document which should certainly be drawn up by a solicitor or a patent agent. The assignment may be to an individual or a corporation or to any number of persons, each of whom as joint owners of the patent will be entitled to exercise the full rights of a patentee. The patentee may assign his rights for a particular district of the United Kingdom, as, for instance, Scotland; and it is probable that if a patentee could show that he had granted an assignment to a person who was manufacturing under the patent in Glasgow, that would be a sufficient compliance with the act.

One word of caution should be uttered to him who makes an assignment of his rights in the United Kingdom. He should make it a term that during the period covered by the assignment the assignee should pay the renewal fees. If he is assigning all his interest, i. e., selling the patent outright, it will be a matter

of little concern to him whether it is kept alive or not; but in that case he should either insist upon having payment outright, or else he should see that the agreement provides for payment of the balance by instalments of fixed amount.

LICENSES.

The disadvantage of granting an assignment lies in the fact that control over the fate of the patent passes largely out of the hands of the patentee. By means of a license, however, he can retain a certain amount of control.

(*a*) *General License.*—By a general license, a patentee confers upon the licensee the right to "make, use, exercise and vend" the invention anywhere within the United Kingdom. It places no restrictions upon the patentee's power of granting other licenses on similar or different terms, and gives the licensee no control whatever over the patent itself. Inasmuch as it will be necessary for the patentee to see that his invention is *worked* in the United Kingdom, he should be careful to make sure that any person to whom he grants a general license will make a proper use of it. In this connection he should remember that the greater number of general licenses granted the less will be the price which he can ask of subsequent licensees. It should also be made plain by the terms of the license that the licensee is to manufacture and sell the article in question, for the mere sale of the article in the United Kingdom would not assist the patentee in complying with the act above considered.

(*b*) *Exclusive License.*—Perhaps the most satisfactory method for the American patentee to adopt will be to grant an exclusive license to some person of whose financial stability and capacity to work the patent as a "going concern" he is thoroughly satisfied. If such a license is granted upon terms of a royalty based on manufacture, the patentee stakes everything upon the licensees possessing the industry and ability required to work the invention to the best advantage. Lest these faculties should be wanting, a term should be introduced into the contract providing for a minimum annual payment as a safeguard against mismanagement and lack of enterprise.

(*c*) *Restricted Licenses.*—A license may be restricted either territorially or else in the sense that it only sanctions the use of the invention in one of several ways. So a man might be licensed to make a patent lamp for heating purposes; if he made it for lighting purposes that would be an infringement of the patent. It should, however, be pointed out in connection with restricted licenses that there is great danger in a patentee attaching any unduly restrictive terms to his license, especially if his object be to encourage use and manufacture within the United Kingdom. Indeed, by the new law passed last year, any such clause may be absolutely void as being in restraint of trade.

USEFUL HINTS WITH REGARD TO LICENSES.

While the drafting of a license should, in a case of any importance, be entrusted to an English lawyer or patent agent, the following hints may be found useful:

(1) The grant of license should be made by agreement under seal, although if made otherwise, and actually performed, its further performance may be enforced.

(2) The covenant to pay royalties should be joined with an understanding on the part of the licensee to produce his accounts for inspection and for verification of the amount of royalty payable.

(3) Provision should be made for possible amendments of the specification, and the payment of renewal fees.

(4) To place a check upon the licensee it should be provided that all articles manufactured under the patent must have a distinguishing mark.

(5) Non-payment of royalty should be made a cause of forfeiture.

While a license lasts, the licensee is estopped from disputing the validity of the patent in question, and even if that is declared invalid, he must continue to pay royalties. As soon, however, as the license comes to an end he may dispute the validity of the patent, and if it is declared invalid, he may continue to manufacture in perfect safety.

Primary Standard of Light.

At the recent Atlantic City convention of the A. I. E. E. Dr. C. P. Steinmetz read a paper dealing with light as a physiological effect and suggesting that this effect be recognized in selecting a primary standard of light. He expressed the opinion that a satisfactory standard can be produced by selecting three primary colors of the visible spectrum. These colors should be of definite wave-length, about equidistant from each other, and of such character that they can be absolutely reproduced at high intensity, as the spectrum lines of a luminous gas or vapor. Then define the unit of light as that given by 1 watt of power radiated at these three wave-lengths, in definite proportions, chosen so as to give white, or yellowish-white, light. That is, the primary unit of light would be defined as the physiological effect, as observed on the white photometer screen, of 1 watt of power radiated in three different wave-lengths. Dr. Steinmetz recommended mercury-vapor lamps as the sources of the three monochromatic radiations, which combined give the primary standard of light. The spectrum lines should be at blue, green and red. Two low-temperature glass-tube mercury-vapor lamps would be required for the blue and green, and one high-temperature quartz-tube mercury-vapor lamp for the red. These would be maintained at constant radiation by maintaining the current constant, and also the condition of ventilation and surrounding temperature. Resolved by a prism, the blue line of the first, the green of the second and the red of the third lamp are thrown on the same white screen, and the flow of their radiation energy measured separately. What energy proportion to select for the three colors to give a color suitable for a primary standard, remains to be investigated. Probably a yellowish-white would industrially be most convenient. It is interesting to note that such a selection of three primary colors as components of a standard of light would also allow an exact numerical expression of the physiological color of any light, by the ratio of the three intensities; that is, the color of light could be measured by varying the intensities of the three standard wave-lengths until their combination, on the white screen, becomes identical in color with the observed light.

DISCUSSION.

Dr. A. E. Kennelly, in a written communication, stated that Dr. Steinmetz's proposal offers a definite chance of realizing a true determination of light in terms of energy, as the outcome of experimental research along three defined wave-lengths of luminous frequencies. A great deal of experimental work will be necessary to develop the method. It will be necessary not only to develop the bolometric method of measuring the energy in the three component beams with a degree of accuracy satisfactory for standard purposes, but also to determine the physiological stimulus of each of these three colors throughout the range of intensity required in photometric measurements.

Dr. Edwin P. Hyde said that the principal difficulty to be overcome in realizing such a standard as Dr. Steinmetz suggests is in accomplishing with the requisite accuracy the absolute measurement of the small amount of energy contained in a single bright line in the visible spectrum. The determination of the proper proportions of energy in the three regions of the spectrum to give the required color, and the reproduction of these three colors in their proper proportions, could probably be accomplished with sufficient accuracy, but the determination of the energy of each region in absolute units would be a much more difficult undertaking. With the adoption of a common international unit of luminous intensity maintained arbitrarily by means of incandescent lamp secondary standards, such as has been proposed, the demand for a suitable primary standard of light is not as urgent as it has been heretofore; it is nevertheless just as important as ever, and the proposal of Dr. Steinmetz to define the standard in watts, with a prescribed spectral distribution, is very suggestive.

A written communication to the discussion was received from Prof. W. S. Franklin, who thought that the method suggested would prove highly desirable, and that it should be thoroughly investigated by the Bureau of Standards.

Mr. Carl Hering explained the relation between the various existing systems of units, and outlined the advantages of avoiding a new system such as has been partly introduced in connection with photometry. One prominent advantage of Dr. Steinmetz's suggestions is in the use of well-known electrical units for expressing photometric quantities.

Dr. C. H. Sharp, after discussing standard of light, expressed the opinion that the method suggested by Dr. Steinmetz seems to possess such merit as to warrant its being given a thorough trial at the Bureau of Standards. He ventured the prediction that difficulties may be encountered in comparing monochromatic and certain polychromatic combinations with the Steinmetz standard of light.

Mr. J. B. Taylor criticised the use of the term "wave length" when defining the quality of light, since the color of light varies with the frequency rather than with the wave length.

Prof. E. B. Rosa, having signified his approval of the suggestions made with reference to the investigation by the Bureau of Standards, upon a motion made by Mr. Carl Hering and seconded by Prof. H. S. Carhart, it was decided to request the Board of Directors of the Institute to ask the Bureau of Standards to undertake a systematic investigation of the primary standard of light proposed by Dr. Steinmetz.

In closing the discussion on his paper, Dr. Steinmetz expressed his disagreement with the various values that have been mentioned as the maximum output in light which can be obtained from a watt of electrical power. He stated that the photometric equivalent of one watt is about 50 cp. This value is based on the assumption that all of the electrical power is transformed into light, and that all of the light falls within the most effective visual range.

Variable-Speed Stroboscopic Fork.

A paper read at the recent Atlantic City convention of the A. I. E. E. by Dr. A. E. Kennelly and Mr. S. E. Whiting dealt with a variable-speed stroboscopic fork for measuring rotative speeds of machines. The fork differs from the ordinary stroboscopic device in that its rate of vibration can be varied through a range of about 5 per cent above or below its mean value, which corresponds to 1800 "peeps" per minute. The variation in rate is obtained by means of sliding masses mounted on the vibrating prongs, graduated scales indicating the exact rate for each setting of the masses. The fork is driven by an electromagnet receiving energy from a 1.45-volt dry cell. By means of a target containing 5 disks with 4, 5, 6, 14 and 18-point patterns, respectively, the fork at its normal speed will indicate any half, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth, twelfth, fourteenth or eighteenth of "synchronous" speed. By suitably adjusting the fork some one of the five patterns may be brought to standstill at any except very low speeds of rotation. The authors state that the degree of accuracy obtained with the fork is much greater than is ordinarily needed in engineering measurements.

DISCUSSION.

The discussion was opened by Mr. J. B. Taylor, who remarked that the stroboscopic fork indicates the absolute speed of rotation, while in many cases one wishes to ascertain merely the difference between two speeds. However, the fork method possesses a great advantage in measuring the speed of small apparatus whose speed would be affected by driving a speed-counter. Prof. Chas. A. Perkins said that it is not necessary to employ an adjustable fork in order to observe speeds that vary slightly from the set speed of the fork. If the speed of the disk is 1795, while the fork speed corresponds to 1800 r.p.m., then the disk will appear to make 5 r.p.m., which can easily be counted. By using suitably marked disks it is possible to observe all speeds encountered by means of three non-adjustable forks.

Dr. Clayton H. Sharp expressed his appreciation of the valuable work done by Dr. Kennelly and Mr. Whiting in reducing the stroboscopic fork method to practical and convenient form for actual use. The instrument is particularly useful in that it is self-contained and can be carried in one's hand to the place where a test is being conducted, and by means of it one can measure accurately speed, variation of speed, or slip, as may be desired.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Fort Dodge Dispute Over Rates.

The Fort Dodge (Iowa) Light & Power Company and the city have settled the differences and disputes that existed between them regarding minimum charges for service. In 1905 the city solicitor petitioned the county attorney on the subject, and ouster proceedings were begun against the company on account of its minimum charge of $1 for electricity and 50 cents for gas. Ever since Mr. W. B. Forshay assumed the management of the company, which was about a year after the original action by the city, he has been trying to settle the dispute. About five weeks ago the company addressed a letter to the Mayor and City Council in which Mr. Forshay agreed to cut the minimum charge in half if the city would pass an ordinance giving it the right to make such a charge. In the course of this letter the company called attention to an important decision by Judge Niles, in the United States Circuit Court for the Southern District of Mississippi, in the suit of the Vicksburg Water Works Company against the Mayor and Aldermen of Vicksburg, in which he said: "The Supreme Court of the United States having finally decreed in this matter affirming and sustaining the rules and regulations of the Vicksburg Water Works Company, and said rules and regulations providing for meter minimum charges, which minimum charges include additional extra services outside of the water furnished by the water company as enumerated in said rules and regulations, to-wit: the reading or recording of the meter monthly, together with cleaning and light repairs of the meter by the water company, when necessary. These are distinct services rendered by the water company, aside from the amount of water furnished, and are proper charges under said rules and regulations, which have been finally sustained by the United States Supreme Court, and the defendants are enjoined from raising said meter minimum questions or any other question in said rates, rules and regulations in this or any other court, State or Federal." The water company holds a franchise in which the clauses restrain it from selling water at a rate above 50 cents per 1000 gal., and the suit was started because it made a minimum charge, which it was claimed did violence to the contract. The Fort Dodge company took its stand upon the identity of these cases, and held the decision to uphold the legality of its minimum charges. Hence it offered the city to compromise on the basis noted, avoiding litigation and expense.

On July 20 two ordinances affecting the compromise were submitted by the city attorney of Fort Dodge and were passed at the first reading on the unanimous vote of the Council.

German Electric Power Rates.

A recent consular report gives some details of several German hydro-electric enterprises under government ownership, from which the following figures as to rates are extracted.

The city of Aix la Chapelle, the county of the same name and two neighboring counties have developed a water power on the River Ruhr through a commission, which also operates the plant. The several owners of the plant purchase electrical energy

wholesale from the commission, paying from 0.976 to 0.88 cent per kw-hour, and selling retail at rates from 5.95 to 9.52 cents per kw-hour for low-tension lighting service; 1.9 to 8.33 cents per kw-hour for low-tension power service, and 1.07 to 5.95 cents per kw-hour for high-tension (5000-volt) power service.

The city of Solingen, which owns and operates a hydro-electric plant, charges 10.71 cents per kw-hour for lighting service when the consumption is below 350 hours per year, and 5.95 cents per kw-hour for use above that number of hours. For power the rates are 4.28 cents per kw-hour up to 750 hours per year, and 1.9 cents for use above that point.

Another plant referred to merely as "Ennepethalsperre" charges 8.33 cents per kw-hour for light and 4.76 cents for power. In addition there is a yearly charge of $7.14 for each motor horse-power, and a further charge, according to the size of the motors, as follows:

Up to 5 hp	$7.14
From 5 to 10 hp	9.52
From 10 to 15 hp	11.90
From 15 to 20 hp	14.28
From 20 to 30 hp	19.04
From 30 to 50 hp	23.80
Above 50	28.56

It is stated that the additional motor charges are assessed to distribute general expenses among motor users. The consular report is probably in error with respect to the extra charge of $7.14 per horse-power.

Electric Light Display at Seattle.

An incident of the recent visit to Seattle of the battleship fleet was an excellent example of decorative street illumination, which was highly complimented by naval officers who had seen similar public illuminations in other coast cities.

Along the principal streets of the city and in line with the sidewalk curbing, strings of incandescent electric lights were strung; the lamps being placed at intervals of 3 ft. and alternating in colors in sets of 10 lamps in red, white and blue. In Pioneer Place the Indian totem pole was festooned from its top to the marginal line of the triangle near the sidewalk with strings of lamps; also in the national colors, giving the effect of an immense cone when the lamps were lighted. Twelve large electric signs, with letters 10 ft. high, spelling the word "Welcome," were arranged on the skyscrapers and along the skyline of the city. The municipal and Seattle Tacoma Power companies' substations, which are located on a hill overlooking the harbor, were outlined in an artistic and complete manner. The Union Railway Station had two large American flags, 10 ft. x 25 ft., worked out in colored lamps on the face of the tower of the station, and just below the flags, were large anchors in light, 15 ft. long.

In the down-town section, many of the business houses made a lavish display of electric lights on the outside of their buildings. The Seattle Electric Company contributed toward the display a battleship 30 ft. long, swung across the street 60 ft. above the ground, in front of its city office. The ship was constructed of sheet iron and worked out in great detail, so that its appearance by daylight was almost as good a representation of a battleship as at night, when illuminated.

The vessel was dressed with flags of the international code, spelling the word, "Welcome," and over the battleship and at one side was a welcome sign made with federal electric sign letters. The hull, superstructure, smokestack, fighting-mast and rigging were outlined with 4-cp lamps. The effect at night was very beautiful and a perfect picture of an American battleship.

Forward on the superstructure were arranged 42 saluting guns, enough for two national salutes. These batteries consisted of 3-amp fuse plugs screwed into an ordinary lamp receptacle. The plugs were filled with black powder and a thin film of mica placed on top of the plug; the brass cap screwed on and the plug dipped in melted fixture wax to make it impervious to moisture. After the plug was screwed into the receptacle, the whole arrangement was wrapped with tape. The battery was wired on two common returns and 21 lead-in wires, which were carried in a cable to the top of the Ralier-Grand Hotel and connected to a plug-in switchboard. The

ELECTRIC LIGHT DISPLAY AT SEATTLE, WASH.

fact that only a few of the charges missed fire speaks well for the moisture-proof arrangement that was adopted, as the battery was exposed to several severe rainstorms before being fired. Tuesday, May 26, as the parade was passing, and just as the head of the column of sailors approached the ship, the national salute of 21 guns was fired. At the crack of the first gun, a large 30-foot flag, unfurled from above the ship, which was accomplished by pull-strings. On the roof of the hotel building a large saluting gun had been provided, and this gun was discharged simultaneously with the discharge of powder from the battleship by electricity—the effect being so perfect that few people discovered the ruse.

The Valuation of Lighting Systems as Related to Rates.

The interesting address of Mr. Henry L. Doherty before the Wisconsin Gas Association, dealing generally with "public service" questions and more particularly with rates and franchises, was presented quite fully in Electrical World of July 25. It has naturally attracted considerable attention at a time when so much thought and discussion are directed to these topics, and when a more attentive ear is being turned to the defence made by corporate management against the various attacks upon it. We are glad now to be able to supplement our report of that issue by the portion of the address dealing specifically with physical valuation methods, the data below being from Mr. Doherty's dictated notes.

Certain elementary points, he says, must be determined. How to determine these points may prove a difficult problem. Such points are:

1. How is valuation of property to be determined?
2. What allowance is to be made for ordinary depreciation?
3. What allowance is to be made for depreciation due to obsolescence caused by
   (a) Outgrowth of apparatus before its useful life is realized.
   (b) Changes in the art.
4. What allowance is to be made for risks due to
   (a) Discovery of natural gas within piping distance.
   (b) Change in the art which will render present investment valueless.
   (c) Developments of new art which will render investment valueless.
   (d) Accidents.
5. What shall be considered as the expense for the interest on the money represented by the value of the plant?
6. What shall be allowed for profit?

"Strange as it may seem, there is no well-defined method of determining valuation. In many of the writings of the men who assume to be authorities on this subject it is assumed that the entire difference between the physical value of a quasi-public corporation and its stock and bond value is represented by its franchise. I cannot do better in illustrating my point than to quote from the report of the Public Policy Committee of the National Electric Light Association: 'It is customary to assume that the entire difference between the physical value of the property and its total value is represented by its franchise value. This is not strictly true. A public service property can have a value aside from both the physical property and the franchise property, which is represented by many factors, among which are (a) operating organization; (b) development of business; (c) advantageous supply contracts; (d) special, general and technical knowledge of the business on the part of operators and directors; and (e) good will. In other words, every business, if a successful business, has a value other than its physical assets, even though this business have no special franchise, and the same values pertain to the public-corporation business even though it have a franchise.'

"The operating company with which I am connected uses a certain method of computing the value of certain items of property, and I recently had occasion to use this in the testimony given at a hearing on this problem. This method is as follows:

"Estimate of minimum value of Blank Company, computed on method used by Doherty Operating Company, and including no values for intangible assets, such as (a) going concern, (b) good will, (c) franchises, etc.

A. Real estate.

B. Physical property (as per inventory at present or minimum value).

C. Omissions, 2 per cent.

D. Engineering and supervision, 5 per cent. of B and C.

E. Ordinary contingencies (not to cover omissions), 10 per cent of B and C.

F. Legal expenses while building.

G. Insurance risk while building—
   Public liability.
   Employees' liability.
   Fire liability.

H. Allowance for fact that property was built piecemeal, 10 per cent of B, C and D.

I. Interest while building, 6 per cent of A, B, C, D, E, F and G.

J. Excess value (based on average cost) of completed property in excess of value based on estimated time and cost of building, 10 per cent of A, B, C, D, E, F, G and I.

K. Cost of organizing company, printing records, engraving stock and bonds and miscellaneous.

L. Working capital—stock accounts—unpaid bills.

M. Unbilled gas and current, 5/30 of
   Electric.
   Gas.

Total physical value.....

Necessary expenditures other than for physical property:

N. Expenses or operating organization prior to completion of plant.

O. Operating expenses in excess of earnings during development period.

P. Interest on investment in excess of earnings during development period being ½ interest for two years on A, B, C, D, E, F, G, J and K and 50 per cent of L and M.

Q. Cost of developing business.

Total investment.....

"Some comment on the above may be desirable. The item C is intended to cover omissions from the inventory. No matter how many times the property would be inventoried by a new set of experts some property would be found which had not been included in the original inventory. The amount of the allowance would depend on how thorough the inventory had been made. In making an inventory on a piece of property that has been operated over a long period of years, the only thing that can be done is to take such values as would be used in an engineering estimate. It is always customary to add to these engineering estimates a sum for contingencies of not less than 10 per cent.

"The item H is to allow for the fact that a quasi-public property has to be built piecemeal, and cannot be built at as low a cost as if it were built in a single operation; and yet if it were built in a single operation it would result in either mistakes in building, due to inability to accurately forecast the growth of the city, or else the putting in of property long before it was needed; and thus due to the mistakes or to the interest on the investment made long before the property was needed, a much greater eventual cost would be had than if the property was built piecemeal. I have assumed that in properties of this sort the work cannot be done as economically piecemeal, and the difference would be at least 10 per cent. I also believe that the piecemeal construction, even with this 10 per cent added, would prove less expensive than to attempt to anticipate the growth and build at one operation. Even though the plant were intelligently built, some property would lie idle for a number of years, and it would be far better to wait until the property was needed even though it meant at that time a greater cost for building.

"In relation to J, I might say that in all the figures given above the cost is arrived at in the same way that an estimate would be made of the cost of building a new property, other than the fact that such an estimate may fail to take into consideration much property that is needed. Therefore, in actual building operations it is not unusual to find that a property has cost, due to mistakes, obstacles, increased time required to build, failure to deliver the apparatus, and a hundred and one other things, a sum equal to double the original estimated cost. Not only this, but a completed property, demonstrated as capable of performing the work for which it was intended, entirely aside from its being a going concern, would represent a much greater value than simply the right to build. This item has been included at the very modest amount of 10 per cent. While I know that most engineers will say you need add nothing to my figures, yet the only men who are capable of testifying on this point will agree that they would at any time give from 25 to 75 per cent more for a completed property ready for operation than accept the estimated cost of building, even where a liberal allowance has been made for contingencies. Not only this, but the only class of people who carry on building operations of this sort must be so organized that they can make a great deal more out of their money than the 6 per cent interest allowance for money invested during the time of building. If you would go to any one of the concerns interested in this class of building operations and would say to them, 'If you will give me 25 per cent more than your estimate I will agree to build that property and turn it over to you, accepting as my loss all delays of every kind, failure or accident of any nature, including the acts of God'—against which no contractor's bond will protect you—'and I will not ask you for one cent of money until I can turn over the property completed and demonstrated as being adequate for the purpose for which it was intended'—your proposition would be accepted without a moment's hesitation.

"The item M must be explained in this way. It is customary for gas and electric companies to read their meters several days before the end of the month. From the date of reading until the end of the month a certain amount of current is sold, and they are entitled to collect the full rate on this. Therefore at the end of any month the amount of gas or current which is registered by the meter, but which has not yet been billed, is an asset which really should be included on the books of the company. If an equal number of days were left outstanding each month, the value of this asset would vary according to the months of the year, but it is a portion of the working capital required by the company.

"In explanation of N it may be stated that prior to the completion of a plant the operating organization must be on hand and be ready to take hold of the work. As a rule the operating organization is employed with the expectation that the plant will be finished on a certain date. Frequently a delay of even as much as a year intervenes, and yet the expense of this organization must be met.

"In explanation of O, I might say that for a long time you cannot even expect a new property to earn its operating expenses, and for a period of considerable time the earnings do not represent the operating expenses. The excess operating expenses over earnings represent a necessary expenditure to complete the enterprise.

"In explanation of P, I might state that after the company has commenced to earn operating expenses, a certain period must intervene before the company will be able to earn interest on the investment; so that the interest on the investment in running along is a legitimate charge against the capital necessary for the enterprise up to the time it commences to earn its interest, and it is just as legitimate a charge to the cost of the enterprise as the charge of interest while building is a legitimate charge to the building operation. I have assumed that no company will succeed in earning more than one-half its interest for the first two years.

"Q—Cost of developing business depends on many conditions. In the particular case cited I allowed for half the gross revenue I was attempting to give the minimum figures only, and I felt that half was the least that could be considered, for I am interested in other properties less developed and I will gladly pay anybody all of the first year's earnings for a development of business equal to the plant I was then invoicing.

"As a legitimate addition to these estimates to determine what the proper capitalization of the company should be, a further allowance should be made for the cost of securing the money, and I will assume that the brokerage, banking and matters of that sort would amount to not less than 8 per cent upon the entire investment.

"There seems to be a disposition on the part of some people to allow for the value of an enterprise of this sort only the value of the physical property. This is absurd. If only this allowance is to be made, any man would be a fool to buy $100,000 worth of physical property, which would require an expenditure of $50,000 or $60,000 more to make it of any value, if the $50,000 or $60,000 which he is compelled to spend to make the physical property of value shall be considered as simply intangible, or as no portion of the real value of the property.

"It is sometimes well to compare the cost of other properties with its value, as determined by its sale price, to determine what the property is worth. The ordinary man who has managed to establish a successful business is very foolish if he is willing to sell it out unless he gets double the amount the physical property will inventory. Were he to establish a successful business and then sell it for anything less than this amount, and attempt to repeat this operation over and over again, he would probably make less money than if he would retain his original business, even though offered double its physical value for it.

"It is also interesting to note that few of the quasi-public corporations have been made to pay in the smaller cities, and yet numerous people were always found ready to put money into these cities in anticipation of their growth. If they had known that it was not intended that they should be allowed any enhancement whatever on the cost price of the property they would certainly have been very foolish to have put their money into a property of this character."

Mr. Doherty pointed to the contrast in treatment received in any given city between the man who put his money into a public service enterprise that built up the community, but was continually in one way or the other denied his fair return and profit, and the man who invested the same amount of money in real estate, left it unimproved, slept upon it, and then took a huge unearned increment without the slightest interference. Such a policy long pursued must inevitably limit and check all extension of public service utilities and industries, with disastrous loss to the public.

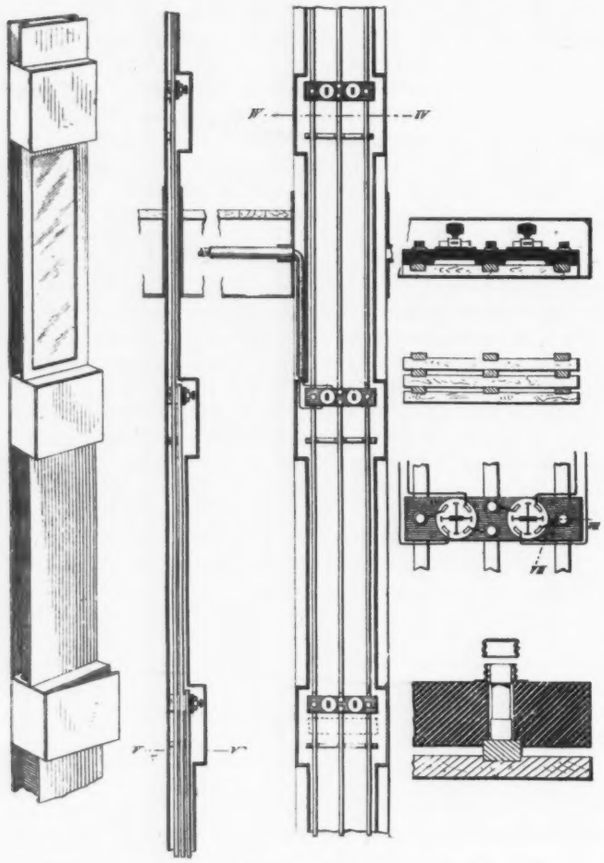
INTERIOR WIRING AND ILLUMINATION

Wiring Construction for High Steel-Frame Buildings.

Where high steel-frame buildings are used the floor space is generally very valuable, and the use of panel boards, which occupy two or three square feet of area of each floor, means a large annual loss in the way of rentals. A patent issued on Aug. 4 to Mr. Adolph L. Goldschmidt, of New York, discloses a construction which occupies only a few square inches of floor space, hardly more than that of the usual mail chute, in proximity to which it may be located if desired. The chute-like arrangement is illustrated in Figs. 1, 2 and 3, while various details are shown in Figs. 4, 5, 6 and 7. Fig. 4 gives a sectional view on the line *IV—IV* of Fig. 3; Fig. 5 is a partial sectional view on the line *V—V* of Fig. 2; Fig. 6 is a top or face view of the structure shown in Fig. 4, while Fig. 7 gives a detail sectional view on the line *VII—VII* of Fig. 6.

The essential principle of the invention lies in the provision

of busbars continuous throughout the entire height of the building to be wired, instead of individual busbars at each local panel board on the different floors, connected by cable and conduit sections, as is now the usual construction. By having vertically extending busbars in this way, the current carrying mains or conductors are made continuous and of uniform cross-section throughout the system, which is a great practical



FIGS. 1 TO 7.—ASSEMBLY AND DETAIL VIEWS OF WIRING CONSTRUCTION.

advantage in that it avoids the usual losses due to numerous splicings and connections. In order to protect the conduit at the points where it emerges from the successive floors, there is provided a cast-iron shield which extends around the conduit, projecting a few inches above the floor level. This plate is sufficiently strong and rigid to withstand the knocks and kicks to which it is subjected, and also provides a ready means for the attachment of conduit pipes through outlet lugs or collars thereon. An important feature of the invention is the arrangement by which distributing bases or blocks can be added or removed at will so as to accommodate the varying requirements of each floor.

The Illumination of Cotton Mills.

In a bulletin issued by one of the large electrical manufacturing companies the following table is given for showing the illumination in foot-candles for various classes of interiors:

Corridors, halls, etc	0.5	to	1.
Depots, assembly halls, etc	0.75	to	1.5
Churches, business offices, libraries, schools, etc	2.	to	3.
Machine shops	2.	to	5.
Stores	2.	to	3.5
Stores (dark goods)	4.	to	6.
Saloons, cafés (depending on the brilliancy desired)	2.	to	5.
Engraving shops, draughting rooms, etc	5.	to	10.

In discussing this table a correspondent asks as to the illumination to be employed when the values given vary between wide limits, as from 2 to 5 foot-candles for machine shops, and inquires concerning the illumination for weave rooms, spinning and card rooms in cotton mills. He also asks the following questions:

"In the July 11 issue of the Electrical World Messrs. Cravath and Lansingh, on page 90, give the number of watts per square foot of floor area required to produce an average of 1 foot-candle of illumination with various kinds of lamps. Please give me corresponding data for the following: Mercury-vapor lamps, 300-watt, 120-volt, 425-cp, for a large room, height from 9 ft. to 14 ft. Direct-current series arc lamps 6.6-amp, 72-volt. Clear inner and light opal outer globes and large room, height from 9 ft. to 14 ft. without reflectors. Alternating-current series arc lamps, 7.5-amp, 72-volt, clear inner and light opal outer globes, height of room from 9 ft. to 14 ft., no reflector being used."

In reply to these questions it may be stated that an illumination of 3.5-foot candles would be a good average for any ordinary machine shop. It should preferably reach 5 foot-candles at the points where machine or hand tool work is being done.

In a weave room an illumination on the machines of 3.5 foot-candles should prove satisfactory. With belts running up more electrical power would be needed to produce this amount than if they run down, and more care would be needed to avoid shadows cast by the belts.

As to the supplement asked to the Cravath and Lansingh table, it may be said that there are not sufficient data at the present time to make it safe to give the data asked, and doubtless that is the reason why figures were not given in the table by its authors. Some idea of the probable performance of the series direct-current arc lamps can be obtained by taking the figures on 110-volt constant potential arcs in the Cravath and Lansingh table and reducing them by about 30 per cent to allow for the watts lost in the balancing resistance in the constant-potential lamp.

Some published tests of mercury-vapor lamps under the conditions mentioned by our correspondent would indicate the watts per lumen to be 0.25, while others show a value of 0.16.

The Lighting of Churches.

In discussing a paper entitled "Church Lighting," presented by Mr. Emile G. Perrot before the Philadelphia section of the Illuminating Engineering Society, Mr. Carl Hering remarked that it is necessary to have shadows in illuminating the face of a person who is addressing an audience in order that the expression of his face may be clearly seen. Hence diffused illumination in front of a speaker's face, or illumination from a number of scattered lamps would be ineffective, because neither of them throws shadows; in such illumination the face would be likely to be equally illuminated all over and would, therefore, look flat and the expression would be lost. The same would be true for a strong light from a reflector directly in front of the speaker, as is frequently used in theater lighting. The other extreme is a single strong beam of light from one side which gives too great a contrast between lights and shadows in the face, producing a sort of Rembrandt effect. It seems, therefore, that to illuminate a face most effectively, one should study the practice of photographers in making portraits, as the photographer has studied the question of bringing out the features of the face more carefully than anyone else. He uses a certain amount of diffused light coming from a limited direction together with some small white reflecting surfaces to accentuate the light from one particular direction above and to one side of the face, so as to produce shadows, but without having any sharp contrasts between lights and shadows.

Indirect illumination from concealed lamps is recognized by all as being beautiful and effective, but it is generally supposed to be expensive on account of the loss of light by absorption. While it is true that there is a great loss of light, another factor enters to overbalance the loss in many cases. The better the details can be seen the more effective is the illumination. When there is a bright, naked lamp in front of the eye the pupils contract and, therefore, the eye takes in less of the light and the

things that are illuminated are not seen as clearly as may be done with less light and a wide open pupil. Hence the fact that there is less light with indirect illumination does not necessarily mean that we see less, but, on the contrary, we may really see better. In many cases one could see more clearly with the subdued diffused light from indirect illumination than with bare lamps glaring in the eyes, on account of the action of the pupils. Therefore, indirect illumination is not only more aesthetic, but even enables one to see better. In other words, although the actual illumination measured in foot-candles would be far less, the things that are seen with wide open pupils are made even more clear than with fewer lamps shining directly into the eyes and thereby contracting the pupils. Mr. Hering expressed the opinion that in the future, although we may not live to see it, illumination will be obtained from large areas of low brilliancy, as from large phosphorescent or fluorescent surfaces instead of from small filaments or arcs of intense brilliancy, according to the practice of to-day. The use of concealed lamps is a step in this direction, though at the sacrifice of much light. When we learn how to produce such low brilliancy surfaces directly, instead of indirectly by reflection from intense lamps, it will probably be found to be a much cheaper form of illumination besides being more effective in most cases.

Prof. A. J. Rowland said that he had never seen an evangelical church which he considered properly lighted. Usually an arch at the platform is put too far behind the speaker to be of any value for use with concealed lamps, or it is nearly directly above the speaker's head where the lamps cast shadows. Sometimes the lamp is under the nose of the speaker sending a glare into his face. He stated that in a certain room the difficult problem of lighting the face of the speaker properly was solved in the following manner: The ceiling of the room was about 15 ft. high, and there were two groups of lamps placed somewhat at the side and near the ceiling. They were arranged in a line with the front edge of the platform, so that the lamps were just in front of the speaker. Such an equipment should light the speaker very well and illuminate anything that he wanted to read.

In the lighting of churches the expense is an important factor for perhaps 80 per cent of the installations. Anything in the way of art glass upon or around the fixtures cuts off the light and increases the expense. Thus artistic and churchly effects are apt to make the lighting expensive. Good and beautiful church lighting is desirable, but it is well to beware of such things as stained glass, which decorators like to use, because good lighting is hard to procure when it is used.

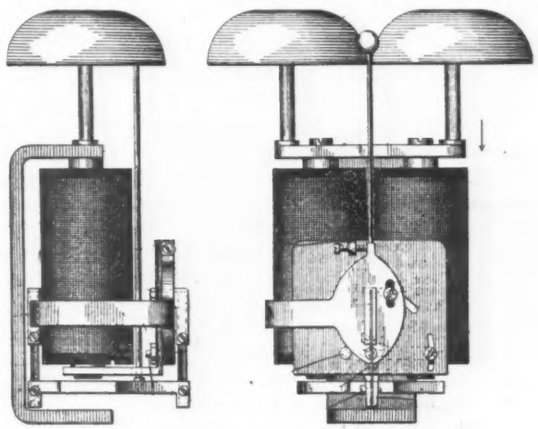
Another thing of importance is the brilliance of light in churches. In some churches where many lamps are provided never more than half of them are used. Sometimes also the controlling apparatus is placed in such an awkward manner that it is impossible to control the lamps without startling the congregation and attracting too much attention.

Mr. Perrot agreed with what Mr. Hering had said concerning a lower degree of illumination from church lighting, by the use of a system which does away with fixtures that allow the naked lamps to be exposed to the eye. Practical experience shows that with the strain of naked lamps on the eyes in certain positions it is impossible to see the center of the altar because the lamps are on top of the pews and just at the level of the eye, and thus interfere with a clear view of the altar. It is impossible to see the other end of the church through these naked lamps, while if those same lamps were arranged on each side of the church so as to make general illumination, although certain parts would not be lighted nearly as brightly as they are now, the effect on the congregation would be nearly perfect. A bright light contracts the pupil of the eye, while if the light is dimmer, the pupil will expand and put the owner more at his ease. People should not be compelled to look through lamps in order to see what is taking place beyond them. As it is necessary to have a bright light on the speaker there is no objection to suspending lamps from the ceiling or putting them on standards, or arranging them in any other way that will throw light on the speaker, provided the desired result is obtained and the naked lamps do not shine in the eyes of the congregation. Art will aid in enriching the bald construction of the fixture, or whatever it happens to be, and will lend its influence to enrich the dark side of the fixture. Whether the solution of the problem is to have a higher foot-candle of illumination or to project light on the speaker will have to be determined by experience.

New Telephone Patents.

NEW APPARATUS.

Herewith is shown a new type of adjustable bell. The large rectangular plate is one leg of an angular base plate, the other



HOBBS ADJUSTABLE BELL.

leg of which is clamped upon the magnet poles. A yoke which carries depending springs is supported upon this. The vibrating armature with attached bell clapper is attached to the springs. The position of the armature may be adjusted with reference to the poles by moving the yoke. The lever, shown dotted, may be moved to effect an up-and-down adjustment, the yoke pivot passing through a slot in the lever. A tilting or biasing adjustment may be effected by the horizontal screw bearing against the top of the yoke, the clamping screw moving in the upper arc slot of the plate. Mr. E. R. Hobbs, of Lamar, Col., is the patentee of this bell, he having made an assignment of the patent to the Dean Electric Company.

Mr. K. M. Turner, of New York City, has patented a loud-speaking telephone for use in halls, etc. A megaphone carries a base block at its small end, pierced by two or more radiating sound passages of exactly the same length and shape. At the base of each is a small telephone receiver, all of them being connected in multiple. All deliver corresponding and superimposed sounds to the magaphone. The General Acoustic Company has been assigned the patent.

CIRCUITS.

A patent for a trunk circuit has been recently granted to Messrs. J. G. Wray and W. G. Kinton, of Chicago, and H. T. Gardner, of Maywood, Ill., and assigned by them to the American Telephone & Telegraph Company. All of the various switching devices necessary for the operation of signals incident to establishing, maintaining and taking down connections are relays, all so interconnected as to perform their functions in proper sequence. The system in its complete form is adapted for direct, two-party and four-party lines, upon the jack per station basis. Upon the plugging up of a trunk, the busy test tap to the operator is cut off, the circuit completed through and any necessary change in the normal type of ringing current is made. Upon the taking up of the trunk at the distant end, ringing current and direct current are alternately supplied in proper intervals, through a commutator. After the response of the called party, the ringing current is cut off and locked out until after disconnection, the signal for which is a lamp controlled by the removal of the distant operator's plug from the trunk jack. Throughout the connection the distant operator

supervises through the aid of her regular cord supervisory, this following the called subscriber's switch hook exactly as though connected to her own exchange.

A cord circuit, for use in connection with a special lock-out party line system, forms the subject of a patent granted to Mr. G. Babcock, of Chicago, and assigned by him to the Stromberg-Carlson Company. The invention lies in including keys sufficient to send currents necessary to the operation of the lock-out system toward either plug of the cord pair, so that under no circumstances is it necessary to change cords during operations.

Letters to the Editors.

Nernst Lamp Efficiency.

To the Editors of Electrical World:

Sirs:—Regarding the criticisms of Mr. A. L. Eustice in your issue of Aug. 8 on the tables published on page 90 of the July 11 issue, we are led to infer that the only correct and reliable information regarding the performance of Nernst lamps is locked up in the archives of the Nernst Lamp Company. Our figures as given in the table were decidedly not the result of manufacturers' tests in any case, as we do not consider that manufacturing companies' tests should have any standing in work of this kind, except possibly as a check on tests conducted by independent, disinterested parties. Furthermore, the figures given in the table were derived, not from theoretical consideration of what lamps ought to do, but on measurements on actual existing lighting installations. The two series of tests which had the greatest weight in the authors' minds in compiling that part of the table relating to the Nernst lamps were, first, tests carried on for the Association of Edison Illuminating Companies by the Electrical Testing Laboratories under the supervision of a committee of illuminating engineers during the summer of 1907; and, second, the extensive tests carried on in the Marshall Field & Company's store, in Chicago, and reported to the Illuminating Engineering Society by Mr. Frederick J. Pearson last October. Both of these series of tests on actual installations indicated to us that the approximate value to be assigned to the Nernst lamp was as indicated. Until similar extensive, authoritative, disinterested tests prove to the contrary, we must consider the figures we gave as correct.

As to the influence of height of lamps on the efficiency, both the latest illuminating engineering theory, as well as results in practice, show that under the conditions given in the table the height can be varied within wide limits without changing the efficiency if the sources of light give a large percentage of their flux downward, as in the case of incandescent lamps with concentrating reflectors or Nernst lamps with their usual globes.

V. R. Lansingh.
J. R. Cravath,

Chicago, Ill.

Exchange of Courtesies Between Engineering Societies.

To the Editors of Electrical World:

Sirs:—I have read with great satisfaction the editorial in your issue of July 18 recommending the exchange of courtesies between engineering societies. This feature of our life is more important than the reading of papers, or even the maintenance of a library, and that society will do the most for the profession and in the long run be the most successful, as a society, which promotes intercourse between its members and also the exchange of views between its members and the members of other societies.

Did you not ask the question I would not feel called upon to mention the fact that the American Society of Mechanical Engineers has for a number of years been exchanging courtesies with other societies, and I am hopeful that in the future this will be further developed. It has been customary for some of the societies with whom we have exchanged house privileges to print on the back of the identification card of their members the names of the several societies to which their members are accredited, and enclosed is such a card.

I am hopeful in like manner that in the building of the engineering societies similar courtesies will be extended, so that members of the professional societies throughout the world will feel free to come to this building and upon presentation of their membership card in the home society be accorded the privileges of the library and rooms of the societies and to participate in meetings, carrying out completely the grand idea which you have suggested.

Calvin W. Rice,
Secretary American Society of Mechanical Engineers.

New York, N. Y.

[The enclosure is a membership card of the Technology Club of Syracuse, on the reverse of which is printed a list of 18 engineering societies and clubs with which arrangements have been made for the exchange of library or club privileges. The New York Electrical Society issues a membership card, renewable annually, bearing on the reverse a request to kindred engineering societies to extend facilities and courtesies to the holder of the card upon its presentation.—Eds.]

Water Power Development in National Forests.

To the Editors of Electrical World:

Sirs:—Referring to the editorial in your issue of July 25 on my paper on "Water Power Development in National Forests," presented at the recent convention of the American Institute of Electrical Engineers, I do not say that the power companies should not pay a privilege or franchise tax, but that if one is paid, it should go to the states which control the streams, the Forestry Department having nothing to do with the water. California has no coal and should get the most benefit of its water powers, and these should not be taxed, as has been suggested, to support or rebuild worn out power sites in the East. Such a policy would lead to Socialism.

I note this in all criticisms: The East wants all it can get out of the forests (the forests are 15 Western states). The West claims you should not tax us for your support any more than we should tax Cuba or the Philippines for our support. The government should keep faith with the people who came West, and if the Eastern people want a direct benefit from the resources of the West, they should come here and help develop them.

All the people obtain the indirect benefit of the Forest Reserves in an insurance of a timber supply and in the reduction in prices of the products of the reserves, of which water-power is one.

I am preparing a more extended article on this subject, which I hope will show the injustice of the present arguments for taxing water-power to support other interests. Note the argument (?) of Governor Folk, of Missouri, before the Conservation Congress at Washington recently:

"If the government does not care to undertake the permanent improvement of the Missouri River, he went on, and if the consent of the government is granted, Missouri is willing to undertake the work, provided that, by act of Congress, Missouri is given the right to use the water-power generated by the river. Applause followed his announcement that Missouri would undertake to do this work and to pay for it out of the revenues derived from the sale of the water-power; and not only that, but to run the state government out of such revenues also. And, he stated, he believed that every state through which courses a navigable stream could and would undertake the same work, under similar conditions."

Please note that "applause followed his announcement," etc., that water-power should be taxed to make the streams navigable and to run the state government as well. I am from Missouri,

and shall be pleased to keep away from there if that is the sentiment of the state. When an intelligent audience will applaud a statement like the above, which is not only untrue but unjust to a particular interest, we cannot but wonder that people reserve their money rather than conserve the water-power.

The greatest benefits will result from the development of water-powers if they are developed in the quickest possible time and the power sold at a reasonable price and put to useful work and to conserve our coal, wood and oil supply. It is of secondary importance who controls the water-power, the State or the Nation.

SAN FRANCISCO, CAL. F. G. BAUM.

The Electrical Engineer and the Public Library

To the Editors of Electrical World:

SIRS:—In this age of improved processes of production and trained effort to cut down industrial waste, there is one agency of progress which still falls far short in many instances of the usefulness that ought naturally to be its pride. More than 10 years' experience in the line of obtaining data and information for use in engineering practice, from public libraries in large cities, has convinced me that radical changes for the better are needed before these institutions can come within hailing distance of their natural and logical usefulness, particularly in the electrical field.

Demands upon the large city library for electrical information are of two kinds. In one case, the searcher knows just what periodical or book he wishes to consult, and in the other, he seeks suggestion from the staff of the library as to the publications wherein any given subject is likely to be authoritatively treated. There ought not to be any serious difficulty about the first kind of library research. Within its appropriation the library ought to know exactly where it stands in regard to the presence or absence of any given publication. Unfortunately this is not always the case, and more than once recently the writer, working inside one of the largest and most famous city libraries of the world, has found the staff utterly unable to definitely run down the location and status of periodicals regularly received, and has had to go away empty-handed with no small feeling of annoyance at the lack of efficiency experienced. Certainly the first principles of decent library management ought to provide for the proper recording of all catalogued matter, so that its presence within the library at any time can be at once determined. There is a tendency in not a few cases to buy certain standard engineering publications for a few years and then to cut them off on the supposition that they are not widely useful. In the writer's opinion, it is a serious matter to stop the reception of a standard periodical, especially in the electrical field, simply because it may not be consulted as often as the *Ladies' Own Weekly*, or the *Monthly Mirror of the Sons of American Independence*. No doubt it is true that the city library must be administered according to the supposed good of the largest number of inhabitants; but considering all the discussions we see printed in the papers after library conventions about "Forming the Public Taste for Solid Reading," and "Encouraging the Downtrodden of the Industrial Régime to Rise Triumphant on the Wings of Self-Acquired Knowledge," it is a question if a little less money spent for cheap, popular novels and a little more devoted to the maintenance of the periodical list useful to the engineering and machinery world would not be productive of lasting good.

The smaller libraries obviously cannot afford to employ anyone capable of distinguishing between the inferior and the excellent in technical literature, but it is high time that someone possessed of an engineering training should be given a free hand to straighten out the kinks and tangles into which some of the larger city libraries seem to have become snarled, especially in the industrial field. Some of the older communities in the East are spending good money for researches in industrial education, by commissions and otherwise. Why should not some of these appropriations be expended in the direction of providing in some of the larger libraries a technical librarian capable of putting the publications into workable condition on the shelves, making sure that all periodicals arrive somewhere near on time, seeing that the volumes are not kept many months at the bindery, watching the various engineering indices for the good of the library user, issuing from time to time special bulletins on appropriate industrial topic references and proving an aid to the uncertain seeker after information to find what he needs.

The smaller libraries can easily combine their efforts in this field, and many engineers of standing would be only too glad to freely advise the non-technical librarian regarding the selection and maintenance of publications.

BOSTON, MASS. HOWARD S. KNOWLTON.

Central Station Accounting.

To the Editors of Electrical World:

SIRS:—Your editorial in the issue of Aug. 1 in reference to the proposed classification of accounts under preparation by the Public Service Commissions of this State was very interesting and, in my opinion, a most timely one. It has seemed to me that the electric-lighting companies not only in this State, but all over the country, are vitally interested in the outcome of this matter and also that they have not awakened to a realization of this fact.

Anyone who studies the tentative schemes thus far prepared by the commissions cannot fail to be impressed with the fact that hereafter there will be the widest publicity given to all the essential details of the public utility businesses.

All the proposed classifications in relation to capital expenditures call for an exact statement of each dollar spent and a minute description of the property acquired as a result of these expenditures. Not only will the records show by accounts the general nature of the property acquired, but the plan provides for the identification of each unit, whether it be an engine, a boiler, a dynamo or part of the distributing equipment. For instance, the accounts will show not only the amount spent on the steam plant, but they will show also the cost of each individual boiler, engine, pump or piece of piping.

Not less interesting is the plan to distinguish between capital expenditures for tangible and intangible property. If the capital of the company includes an amount for franchises, patents, good will, cost of raising money or any other related purpose, the accounts are so arranged as to show the details of the transactions.

As with the capital expenditures, so with the income accounts; they provide for the most complete and thorough analysis of the earnings and the expenses. The requirements as to depreciation charges are rigid and those who heretofore, for one reason or another, have postponed consideration of this problem must now decide the amount which is to be provided for depreciation before their divisible surplus can be determined.

The accounting committee of the National Electric Light Association has conferred with the representatives of the commissions in the statistical department and has also taken part in public hearings on accounting matters held by the commissions. The classification published on June 5 last, if compared with the first tentative classification, shows the effect of this work. The commissions are seeking information, and while they feel that the classification which they will adopt should be framed in sufficient detail to bring out all the facts of the business, they at the same time do not wish to impose a burden on those companies that do not require an elaborate bookkeeping system How can this problem be solved? This, at least, can be stated: That the problem never will be solved until it is solved correctly, and that it will not be solved correctly until the interests of both the companies and the commissions, as representing the public, have been adequately presented and considered.

This is the time for the companies to make their wishes

known, and I trust that through the medium which you have provided they will take advantage of their opportunity.

H. M. Edwards,
Chairman of the committee on a uniform system of accounting of the National Electric Light Association.
New York.

To the Editors of Electrical World:

Sirs:—Referring to the editorial in your issue of Aug. 1 on "Uniform System of Accounting in New York," I have looked over the proposed system of accounts very closely and the criticism occurs that while for some plants the system might be beneficial, for other plants it would be too burdensome. For large plants a thorough system of accounting is undoubtedly invaluable, particularly for those plants that are so large that the manager cannot possibly be familiar with all the details except through reports at stated periods; but in the case of plants located in villages of 2000 people and less, the expense account is apt to be of such a varied character as to make it almost impossible to classify.

For example, the writer is president and manager of the Cascade Chair Company and also of the St. Regis Light & Power Company, and with very few exceptions the personnel of both corporations as to stockholders is almost identical. Both corporations also use the same water power and occupy the same buildings, and for a number of years an arrangement has existed between the two whereby the Light & Power Company furnishes light to the Cascade Chair Company and the latter furnishes attendants for the generator, as the boiler room adjoins the generating plant; and this policy applies to other details, such as repairs, as the repair men working for either corporation do the repairs for both, and to clerical work, which is all performed in one office. It is impracticable to place in any manner a fixed value on these services. Last year's report to the commission was returned with a request for the cost of attendants at the generating station and salaries of executive officers, whereas both classes received their compensation through the Chair Company. I, of course, recognize that this condition is a little unusual, yet at the same time I do not think it is a rare condition, by any means, in the case of smaller plants, as I can enumerate very many that are operating practically under these conditions. The plants in smaller towns are invariably operated in connection with saw mills, grist mills or some other similar manufacturing plant, and utilize the power at night that would not otherwise be used.

There are many other questions that are almost impossible to answer. For instance, in large plants where they have many attendants, linemen and so forth, it is an easy matter to tabulate the expenses for any one thing, but this is not true of smaller plants—ours, for instance, where we keep only two linemen and these men not only do our wiring but repair other plants around nearby, do telephone work, read the meters, collect the pay and sometimes perform a dozen services of similar character in one day. Moreover, the Tax Commission asks for a report ending at one time of the year, the Special Franchise Commission at another, the State Treasurer at another and the Public Utilities Commission at still another, and I think if I am compelled to supply these reports, they should at least all be for the same period.

There is another criticism and one which I think is perhaps more important than all the rest, namely, that the reports and system of bookkeeping require altogether too much technical knowledge, both with respect to bookkeeping and details of equipment, for the average manager, who is often sole owner. I think that for plants in villages of 2000 and under, the annual report should be as simple as possible, requiring, for example, the cost of operation under three or four heads, such as office expenses, taxes, attendants, extraordinary expenses, such as renewals and general line work, and then on the other side the income from flat rates, meters and power. Even a simple system like that above suggested would be about all many of the managers of the smaller plants could cope with through their lack of technical knowledge of bookkeeping and electricity, while the systems which have heretofore been suggested are so complicated as to require almost an expert to aid in making up a report. Excessive reports would be an economic waste, not only to the lighting companies, but to the State. I think that the aim of the commission is to see that lighting companies are furnishing good service at reasonable prices, and at the same time to protect these companies against unjust competition; and whatever accounting system is finally adopted, it should be well within the abilities of the managers of the smaller plants to handle. I am very glad of this oppor tunity to add my voice to that of the multitude who are demand ing a more simplified method than has yet been suggested.

St. Regis Falls, N. Y. H. E. O'Neil.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Three-wire Generator.—A note on a recent British patent of J. Burke for a direct-current generator for supplying a three-wire distribution system. One or more auxiliary windings are wound in the same slots as the main armature winding, but with half the number of turns. If one auxiliary winding is used, one end is connected to a point on the main winding and the other end to a slip-ring on which bears a brush in connection with the neutral conductor of the three-wire system. If more than one auxiliary winding is used they are connected together at the slip-ring, the other ends being connected to equidistant points on the armature winding. The neutral conductor is thus maintained at a pressure half-way between the two outer conductors, as an e.m.f. is generated in each auxiliary winding, which, if added to the instantaneous value of the potential of the point of the winding to which it is connected gives a constant potential at the slip-ring. The auxiliary windings also afford a path for the out-of-balance current. Where the system is much out of balance, better results are obtained with more than one auxiliary winding. The auxiliary winding must be so distributed that its parts are subjected to magnetic variations similar to those to which the main winding is subjected.—Lond. *Elec. Eng'ing*, July 16.

Split-Pole Converters.—J. E. Woodbridge.—An illustrated discussion of the principles of the new "split-pole converter" of the General Electric Company, which gives a means of varying at will the ratio of the commutator e.m.f. to the collector-ring voltage by the variation of the excitation alone. The operation of the converter is explained by the aid of vector diagrams and some notes on the wave shapes of the machine and on the quality of commutation are added.—*Gen. Elec. Rev.*, August.

Lamps and Lighting.

Tungsten Lamp.—An illustrated article on the tungsten lamp made by the British Thomson-Houston Company. It is intended for use on 110-volt circuits, gives about 40 cp and consumes about 50 watts. Its dimensions are 6¼ in. in length by 2⅜ in. in diameter. These lamps are also being made suitable for use on 25-volt and 50-volt circuits in conjunction with auto-transformers. Such lamps may be substituted for the ordinary 16-cp carbon lamp without any alteration in the fitting being necessary. The 25-volt lamp is supplied in two ratings consuming 12.5 and 20 watts, and having candle-powers of 10 and 16 respectively. The 50-volt lamp is supplied only in the latter of these ratings. The 100-volt lamps suitable for series operation are marked with a series number, and no lamp hav-

ing series numbers more than one point apart should be used together. Thus, lamps numbered 47 may be burned with lamps numbered 46 or 48, or, in exceptional cases, with 45 or 49, but with no others.—Lond. *Elec.*, July 17, and *Lond. Elec. Eng'ing*, July 16.

Tungstem Lamp.—A note on a recent British patent of the Allg. Elek. Ges. Thin filaments are made from finely powdered tungsten or molybdenum, or from oxides of these metals, with the addition of a binding material. To free the filaments from the carbon contained in the binding material, they are moderately heated in a limited quantity of air. Afterward they are heated to a temperature higher than 1500 deg. C. in a reducing, carbon-free gas, for instance hydrogen, in order to reduce the oxides and sinter the filaments together. If this is done in an electric vacuum furnace, the latter must be lined with thorium or magnesium oxide to prevent fusion of the filaments to the sides of the furnace.—Lond. *Elec. Eng'ing*, July 16.

Incandescent Lamps.—The conclusion of the long illustrated serial on recent progress in incandescent lamps. The descriptions are taken from patent specifications. In the last installment descriptions are given of several constructions which are interesting on account of their peculiarity, though they may not be of practical value. Among them is a lamp of a Russian who places a revolving mirror system within the center of the filament loop. The filament is between the mirror system and the glass globe and the mirror system rotates on the principle of the radiometer. The inventor seems to think that he can increase the candle-power by the repeated reflections of the light of the filament from the mirror surfaces.—*Zeit. f. Beleucht.*, July 10.

Control of Arc Lamps.—A. GESE.—In order to know whether an arc lamp is lighted, the author connects a small incandescent lamp in parallel with the series resistance of the arc lamp. This incandescent lamp is mounted on the switchboard and indicates not only whether the arc lamp is lighted, but also whether the regulating mechanism operates properly.—*Zeit. f. Beleucht.*, July 10.

Generation, Transmission and Distribution.

Electric Motors in a Ship-Building Plant.—An illustrated article on the electrical department of Sir W. G. Armstrong, Whitworth & Company's Elswick Works. Energy is supplied from two outside companies to substations within the works. Three-phase motors are adopted for driving shafting and for constant-speed requirements, while a three-wire 480-volt system is provided for variable-speed motors and for lamps. In each of the four direct-current substations balancers sufficiently large to deal with out-of-balance loads are installed in duplicate. These loads are sometimes considerable, owing to the action of electrically-driven cranes and other intermittent demands. Each substation has, under normal conditions, one balancer set running. Should the out-of-balance load exceed 200 amp for more than 10 minutes another balancer is placed in service. The article describes especially the provisions made for electric equipment of ships, wiring generators, etc.—Lond. *Elec. Eng'ing*, July 16.

Motors in a Colliery.—An article on the electric equipment of the Harden Colliery in England. The generating plant consists of two 250-kw, 500 volt, direct-current dynamos. Motors are used underground for ventilation, haulage, pumping, etc.—Lond. *Elec. Eng'ing*, July 16.

Traction.

Rail Corrugation.—CARUS-WILSON.—A paper read before the Tramway and Light Railways Association. The author thinks that corrugation is due primarily to the wheels running on unequal diameters, which, combined with the presence of grit on the rail, produces intermittent skidding. There are four conditions which must exist at the same time to produce corrugation, namely, (1) a defective track producing grinding and check cutting; (2) defective rolling stock, that is, bad wheel section; (3) the presence of grit on the rail; and (4) the critical speed. While no remedy is suggested, it is stated that the first step toward a remedy is that all should be agreed upon the correct diagnosis of the disease.—Lond. *Elec. Eng'ing.*, July 16.

Installations, Systems and Appliances.

Battery-Booster Plant.—An illustrated article on the use of battery-booster plants for rapidly varying loads. The installation on a dock in Manchester is described. The generating plant consists of three 200-kw turbo generators. In parallel with the busbars are 240 cells, capable of giving 420 amp for one hour, and in series with the battery is an automatic reversible booster. The lighting is on the three-wire system, a balancer being run in conjunction with it. Both the motor and the lamp loads are supplied from the same busbars, the battery and booster furnishing the difference between the mean generator load and the minimum requirements of the line load, thereby maintaining a constant load on the generators and a steady voltage on the busbars. With a battery in series with a really sensitive reversible booster, the busbar voltage can be kept constant within 1 per cent of the mean, if the discharge from the battery does not exceed the one-hour rate.—Lond. *Elec.*, July 17.

Controllers for Large Motors.—An illustrated description of a large controller of English make to be used with a 400-hp, 2750-volt, three-phase reversible haulage motor, so arranged as to provide 50 per cent continuous speed regulation if required; provision is also made for running very slowly for winding in the haulage rope. In order to reduce the space of the resistors to a minimum, they are placed in enclosed tanks filled with oil and a system of copper cooling pipes is provided through which water is pumped to cool the oil. The speed of the water is regulated according to the working conditions of the load.—Lond. *Elec. Eng'ing*, July 16.

Wires, Wiring and Conduits.

Free Oscillations in Transmission Lines.—K. W. WAGNER.—A mathematical paper read before the German Association of Electrical Engineers. If in a transmission line a sudden change is produced, then the original stationary condition does not change immediately into the new stationary condition, but there is a transitory period. This transitory period is characterized by free oscillations. This can be expressed mathematically by the fact that the current during this transitory period can be written as the sum of the final current in the new stationary condition plus the free-oscillation current. The e.m.f. may be written in the same way. The statement often made that the wave length of the fundamental wave of the oscillations equals four times the length of the line is wrong in general, being correct only in case the line is open at one end and short-circuited at the other end. The wave lengths of the fundamental waves and the higher harmonics depend upon the conditions at the ends of the line, and the apparatus contained in the line. The e.m.f. during the transitory stage may be considered as the result of superposition of two waves traveling in opposite directions with a certain speed and decaying in amplitude according to an exponential law. The current may also be considered as a sum of two such waves. The recognition of the conditions under which excessive voltages are produced enables one to determine the suitability of different protective devices for special cases.—*Elek. Zeit.*, July 23.

Alternating-Current Underground Distribution.—S. D. SPRONG.—The first part of a long serial on alternating-current underground distribution. The first installment gives historical notes on early work of the United Electric Light & Power Company in New York City in the eighties. The first commercial alternating-current lighting in New York City was done in 1889.—*Gen. Elec. Rev.*, August.

Hard-Drawn Copper Wire.—W. H. BASSETT AND J. A. CAPP.—A paper read before the American Society for Testing Materials on the desirability of standard specifications for hard-drawn copper wire.—*Gen. Elec. Rev.*, August.

Electrophysics and Magnetism.

Electronic Theory.—W. H. JULIUS.—A lecture on the exchange of energy between systems of electrons and especially

on the theory of radiation on the basis of electronic conceptions. The author discusses Stefan-Boltzmann's law of total radiation and Wien's law of the displacement of the radiation maximum with temperature and Planck's law giving the radiation as a function of the wave length. He then discusses the reasons why no equilibrium of radiation has yet been established in the world and discusses especially radiation pressure and refraction.—*Phys. Zeit.*, July 15.

Brownian Movements.—M. Seddig.—An account of experiments in which the influence of temperature on Brownian movements was studied. The author considers his results as a direct experimental confirmation of the conceptions of the kinetic theory of heat. The Brownian movements of the small suspended particles give a rough picture, directly visible to the eye, of those thermal movements of the molecules of the liquid which are the cause of the Brownian movements.—*Phys. Zeit.*, July 15.

Resistivity of Silicon.—F. G. Wick.—An account of measurements of the change of electric resistivity of electric silicon at temperatures between —200 and + 400 deg. C. The results obtained with four cast silicon rods marked 1, 2, 3, 4 are given in Fig. 1. The rods seem to belong to two different groups.

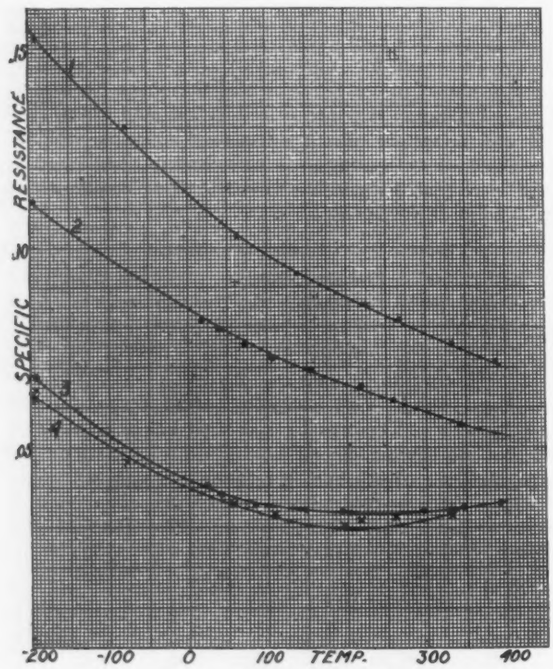


FIG. 1.—RESISTIVITY CURVES.

For one the temperature coefficient of resistivity is negative throughout the range measured. Rods 1 and 2 belong to this group. For the other the coefficient is negative from the lowest temperature measured to about 200 deg. At this point a change takes place and the coefficient becomes positive. These results show a lack of uniformity in the resistivity of different specimens of the same lot as well as in the effect of change in temperature upon the resistivity, indicating that the resistivity of metallic silicon is very sensitive to changes in purity, physical constitution, crystalline structure, or variations of some other sort the exact nature of which, in this case, is not known.—*Phys. Rev.*, July.

Magnetic Rotary Polarization.—St. Landau.—An account of measurements of magnetic rotary polarization in the ultraviolet part of the spectrum. The author uses a photographic method which appears to be very sensitive. The results obtained agree with the general formulas of the electronic theory This is a proof not of the correctness of the theory, but of its usefulness, since a much closer agreement may be obtained with the new electronic theory than with older interpolation formulas containing the same number of constants.—*Phys Zeit.*, July 1.

Magnetic Rotary Power.—J. Becquerel.—A note on the dispersion of magnetic rotary power in the neighborhood of bands of absorption in the case of rare earths, with remarks on the subject of recent communications by R. W. Wood and G. J. Elias. The present author thinks that among the various bands some are due to vibrations of negative electrons (as in the phenomenon of Zeeman), but that others are produced by positive electrons which thus appear for the first time in optical phenomena.—*Phil. Mag.*, July.

Cathode and Canal Rays from Hollow Cathodes.—J. Kunz.—An account of an experimental investigation of the nature of canal rays starting from cathodes made of two separated parallel metal plates of different shape.—*Phil. Mag.*, July.

Radiation Formula.—O. Lummer and E. Pringsheim.—A note criticizing the radiation formula of Jeans and Lorentz, which is shown to lead to consequences in disagreement with established facts.—*Phys. Zeit.*, July 15.

Electrochemistry and Batteries.

Induction Furnace.—J. Harden.—A paper in the first part of which some notes are given on observations of the "pinch effect" in induction furnaces. An explanation is then given of the shape of the curve showing the voltage across the terminals of the furnace during melting. While for comparatively small quantities the original induction furnace is an almost ideal crucible steel furnace, the author thinks that for large-scale work (making rails, etc.) the Roechling-Rodenhauser modification will be more suitable. This furnace works partly by induction and partly by conduction, neutral side plates (which he does not wish called electrodes) being provided for the latter purpose.—*Elec. and Met. Ind.*, August.

Aluminum.—J. W. Richards.—The conclusion of his series on metallurgical calculations. The author discusses the principles of the Hall process and gives a numerical example.—*Electrochem. and Met. Ind.*, August.

Zamboni Pile.—G. C. Simpson.—In the use of the ordinary Zamboni pile, the liability of breakage of the ebonite rod in the center is very annoying. The author uses metallic rods covered with a layer of sulphur.—*Phys. Zeit.*, July 15.

Units, Measurements and Instruments.

Magnetizing Curve with Alternating Current.—O. S. Bragsted and J. Liska.—An article illustrated by diagrams in which the authors first point out the errors in using "static" magnetizing curves for determining the magnetizing curve in the case of alternating current. These errors may be avoided and the method of measurement may be simplified by plotting and using the "dynamic" instead of the static magnetizing curve. The iron under test is placed into the testing apparatus and while the impressed voltage (and therefore also the induction) is varied, the current voltage and watts are measured. The arrangement of the test is shown in Fig. 2. From the readings

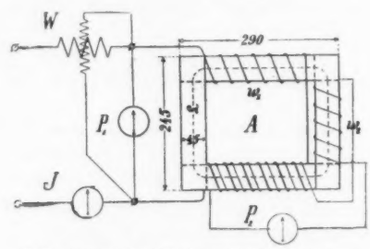


FIG. 2.—DIAGRAM OF ARRANGEMENT.

of the instruments the wattless and the power components are calculated and are multiplied by the number of magnetizing turns and divided by the mean length of lines of flux. These final values are called by the authors $a\,w_w$ and $a\,w_{w1}$ and are plotted in curve form as functions of the maximum flux density. The flux is determined most easily from the e.m.f. induced in a few secondary windings w_2. As the source of current a sufficiently large alternator is to be used to give a voltage wave form which is not pointed. Fig. 3 gives the magnetizing curves $a\,w_w$ and $a\,w_{w1}$ for armature sheets 0.5 mm in thickness with

a frequency of 50 periods; with a frequency of 25 periods the watt-component curve is represented by $a\,w'_w$, while the curve of the wattless component is the same as for a frequency of 50 periods. The scale of abscissas for the curves $a\,w_w$ and $a\,w'_w$ is 10 times that of the curve $a\,w_{w1}$. In the illustration the static magnetizing curve is also given for comparison; this is the curve $a\,w_s$. The authors then discuss the calculation of

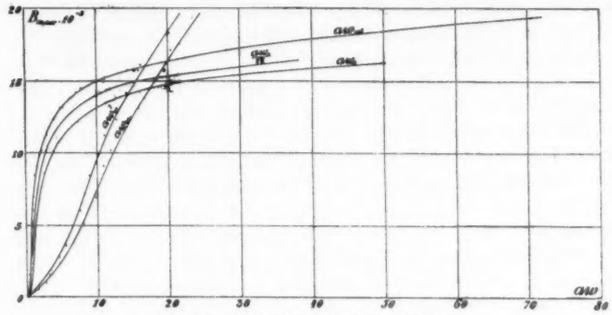


FIG. 3.—MAGNETIZATION CURVES.

a magnetic circuit with varying cross sections, and apply their method to the determination of the magnetizing current of a transformer with an inductive load.—*Elek. Zeit.*, July 23.

Measuring Capacity.—R. BEATTIE.—An article on some methods of measuring capacity with alternating currents of complex wave form. The so-called "direct" or "ammeter-and-voltmeter" method of determining capacity by alternating currents consists in measuring the effective value I of the current in the condenser under test and the effective value E of the e.m.f. across its terminals. The required capacity is then given by the formula $C = \frac{I}{E}\omega$, where ω denotes 2π times the frequency of supply. Only when the applied e.m.f. is simple periodic does this method give entirely reliable results, however. Even with an e.m.f. differing but slightly from simple periodic, comparatively large errors may be expected, and if the experiment be made by connecting the condenser to ordinary supply mains, the e.m.f. wave form of which is often very irregular in character, the results obtained by applying the above formula may have little apparent relation to the true capacity. The cause of this discrepancy is found in the higher harmonics present in every irregular e.m.f. wave. The simplest method to overcome this trouble is to insert a non-inductive "swamping resistance" in series with the condenser under test. The effect of this is to render the e.m.f. across the condenser terminals approximately simple periodic, even though the supply e.m.f. may have a very irregular wave form. To secure this result, however, it is necessary that the value R of the swamping resistance should be numerically large compared with the value $\frac{I}{C\,\varepsilon}$ of the condenser. Should any doubt exist in a given case as to the adequacy of a swamping resistance, a "swamping choker" (which must be ironless) may be used in its place. This is much more effective, and may be relied upon to render the e.m.f. across the condenser terminals approximately sinusoidal even with a very distorted supply e.m.f. wave. The best results are obtained with a choker adjusted to have a reactance numerically equal to that of the condenser. In this way the fundamental is brought into resonance, and it is under these conditions that the choker acts most effectively in swamping the higher harmonics. The author then describes methods of measuring capacity which involve a comparison with a known capacity or with a known inductance and the use of Sumpner's iron-cored wattmeter.—Lond. *Elec.*, July 17.

Perforation Voltage and Temperature.—A. GRAU.—In testing an insulating material as to its perforation voltage, the voltage is increased step by step until the material breaks down. For such purpose alternating e.m.f. is always used and it is well known that a material subjected to the alternating voltages is gradually heated. The perforation voltage depends on the temperature. For instance, stabilite plates when tested at 86 deg. C. broke down at 23,500 volts; at 22,000 volts at 92 deg. C.; at 20,500 volts at 20 deg. C., and at 18,500 volts at 115 deg. C. When a solid insulating material is subjected to an alternating voltage, the temperature gradually rises until after a certain time a stationary condition of temperature is reached. To each voltage there corresponds a certain final temperature which is reached only after some time. In testing, enough time should always be allowed to enable the temperature to rise to its final value. If the voltage is raised too quickly from step to step, the final temperature which would correspond to the testing voltage as explained above is not reached and the value of the perforation voltage which is found is too high, because it corresponds to too low a temperature.—*Elek. u. Masch.*, July 5.

Standard Battery.—G. A. HULETT.—An illustrated description of a simple standard battery without temperature coefficient of e.m.f. which is useful in work with the potentiometer and for all purposes in which a small but steady current is needed. The cell, which is a modification of the Weston cell, is shown in Fig. 4. A small bottle is sealed with a paraffined cork which is perforated by two holes so as to hold the anode cup A (containing amalgam) and the tube B through which contact with the mercury cathode K is made. Resting on the mercury and surrounding the anode cup was a 50 per cent solution of cadmium sulphate to which was added one per cent of sulphuric acid. By passing a current in through the mercury electrode K, mercurous sulphate was formed and cadmium was deposited in the amalgam in the anode cup. The chief novelty is the addition of sulphuric acid to the electrolyte. The value of the e.m.f. of these batteries is the same whether the mercurous sulphate is made and washed in the usual way or made electrolytically in the batteries. They are reproducible to less than one part in 1,000, regardless of ordinary temperature changes, and the e.m.f. is 1.022 volts (Clark cell at 15 deg. = 1.4330 volts). When calibrated they have served for exact measurements of e.m.f. or for furnishing a small current. With a bridge of known resistance and a large regulating rheostat, small electromotive forces may be accurately measured by the null method and with simple apparatus. —*Phys. Rev.*, July.

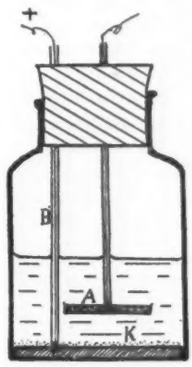


FIG. 4.—STANDARD BATTERY.

Tests of Cables.—C. FELDMANN AND J. HERZOG.—A translation in abstract of their recent German paper on the testing of high-tension cables. The advantages of grading the insulation of cables are discussed, and an example is given in support of this view. With regard to the testing of cables, prolonged application of excessive voltages is considered to be harmful, for any fault should be discovered in quite a short time. Some interesting phenomena, obtained when overhead lines are subjected to very high tensions, are also described.—Lond. *Elec.*, July 17.

Plug Permeameter.—C. V. DRYSDALE.—A note on his plug permeameter, which has been described in the Digest and which was devised for making permeability tests on castings and forgings for dynamo work. The author has made a series of experiments from which he concludes that the plug permeameter, in reasonably careful hands, gives as good results as any other method of iron testing, so far as permeability tests are concerned.—*Phil. Mag.*, July.

Alternating-Current Instruments.—C. V. DRYSDALE.—His Brit. Phys. Soc'y paper (an abstract of which has been noticed in the Digest) on the use of shunts and transformers with alternating-current measuring instruments.—*Phil. Mag.*, July.

Telegraphy, Telephony and Signals.

Neutralizing Induction on Telegraph Lines.—A note on a recent British patent of the British Thomson-Houston Company (General Electric Company of this country). To protect telegraph or telephone conductors which run adjacent to rails used

as return conductors on alternating-current railways, from induction, a neutralizing conductor connected in shunt to the rails is placed near the conductor to be protected. This will neutralize the electromagnetic induction, and since the rails are earthed, will also partly neutralize the electrostatic induction. Resistances may be required in the shunt circuit to reduce the current to the proper amount. For the same purpose a transformer may be used, the primary winding being in series with the rails and the secondary with the neutralizing conductors.—Lond. *Elec. Eng'ing*, July 16.

Miscellaneous.

Spherical Gaseous Nebula.—Lord Kelvin.—A posthumous mathematical paper on the problem of a spherical gaseous nebula. It is shown that for such gases for which alone a "convective equilibrium" can be realized, the central temperature of a globe of gas in equilibrium increases, through gradual loss of heat by radiation into space. The internal energy of the globe of gas continuing in a condition of approximate equilibrium while heat is being radiated away across its boundary, would go on increasing, and the work done by the mutual gravitation of its parts would go on increasing, till the gas in the central regions became too dense to obey Boyle's law. At the same time the radius of the globe would diminish. In other words, the repulsive power which the globe of gas possesses by virtue of its internal energy, while in approximate equilibrium, is, owing to gradual loss of energy by radiation, at each instant just insufficient to exactly balance the attractive force due to the mutual gravitation of its parts. The globe is therefore compelled to contract; and, as the heat due to the contraction is not radiated away so quickly as it is produced, the shrinkage of the globe is accompanied by augmentation of its internal energy. As condensation continues with increasing total energy, a time must come when the resistance to compression of the latter in the central regions must become much more than in accordance with the laws of perfect gases; and after that occurs, the cooling at the surface, with continual mixing of cooled fluid throughout the interior mass, must ultimately check the process of becoming hotter in the central regions, and bring about a gradual cooling of the whole mass. This theory is applied to the sun and it is found to be certain that the sun is not gaseous as a whole. Examples are finally given of the application of this theory to spherical masses of argon and of nitrogen. There is a mathematical appendix by G. Green.—*Phil. Mag.*, July.

Soldering.—A. Lippmann, A. Binz and E. Hohler.—Letters of a polemical nature concerning two commercial soldering materials of German make with special reference to the question whether the presence of zinc chloride is disadvantageous because it produces hydrochloric acid.—*Elek. Zeit.*, July 9.

BOOK REVIEW.

Dynamo Electric Machinery. By Dr. F. B. Crocker. Cloth, 235 pp., 260 illus. American School of Correspondence, Chicago, 1908. Price, $1.50.

This admirable treatise is one of a useful series of text books based primarily upon instruction courses for correspondence students, but none the less valuable on account of that restriction. The correspondence school has been a mighty educational force in America, and their name is legion who can look to it with gratitude for the instruction it has given them, and for the higher plane of living and thinking upon which it has placed them. Here we have a net, concrete example of the methods by which such notable and praiseworthy results have been accomplished. Dr. Crocker's work at Columbia University, New York, is necessarily of the viva voce character, in that he deals face to face with crowded classes and must employ the larger, freer style of communication. But even when this direct oral tuition is reduced to cold type, his individuality stands out, and one realizes the actual presence of the vital teacher.

Developing his theme in natural sequence, the author takes up the theory of electromagnetism, carries it forward into moving apparatus, and then gives the constructive details, the calculations for design, the characteristic curves, and the actual proportions and physical embodiments of dynamo electric machinery of the direct or continuous current type. No feature seems to have been omitted, and that which might have been merely academic becomes wholly practical in the treatment of one whose work speaks also in successful commercial machines of a notably individual type.

Professor Crocker has not been abstemious of oratory or print and hence is at the disadvantage of being judged by what has gone before. But good as his previous work has been, he may be said in this work to have crystallized clearly and summarized succinctly the fruitful results of study, practice and didactic disquisition, and is to be congratulated upon a book that to a certain extent does him justice and that cannot fail to be a helpful guide to the aspiring electrical engineer. In typography and general get-up the volume is excellent, although the index might well be more ample in its scope.

NEW APPARATUS AND APPLIANCES

Storage Battery Negative Plates.

Considerable light is thrown on an improvement in storage batteries by a recent decision of the Patent Office terminating an interference between Mr. Hugh Rodman, of the Westinghouse Machine Company, and Mr. Joseph Bijur, of the General Storage Battery Company, by award of priority to Mr. Bijur. As the limit for appeal has terminated, this decision by the Patent Office, between the two parties, is final.

The subject of this controversy was an improvement in negative pole plates for storage batteries of the Planté type, which is covered in patent No. 845,391, granted to Bijur. Ordinary Planté negative plates exhibit a marked tendency to diminish their capacity, and to such an extent that even when the plates start out with a capacity of 80 to 100 per cent more than that of the positive plates with which they are used, their capacity may fall to less than that of the positive in a comparatively small number of discharges. In fact, this diminution of capacity continues so that eventually the negative plates have less than half of the capacity of the positives. The aim of Rodman and Bijur were identical, namely, to remedy this defect by introducing some inert and insoluble substance into the previously formed pores of the plates, whereby apparently the contraction of the pores, which was supposed to be at the root of the trouble, would be diminished or prevented. The result of such treatment prevents a large part of the loss of capacity which would otherwise occur, and plates of commercial size, when treated after the manner mentioned, maintained a capacity above that of the positives for an almost indefinite time. Planté negative plates have always possessed the property of being mechanically durable, but have not been electrically perfect in this respect. The invention thus ranks among the most important improvements in the storage battery art made in recent years, and appears to mark a new era for Planté negatives.

One of the remarkable characteristics of this invention is that the process can be successfully applied to negative plates which have lost capacity in use. Such plates, when impregnated with a suitable inert substance, regain their full capacity in a few discharges, and then retain it the same as if they had been impregnated before use.

Rodman's plate was impregnated with an organic salt, Bijur's plate with the organic substance carbon. The claims of the Bijur patent are very broad, and not limited to any particular solution nor to any special impregnating substance.

Improvement in Transformer Performance.

Probably the most prominent improvement that has been made in transformer performance during recent years has resulted from the use of the new so-called "alloy steel," which exhibits the extremely advantageous characteristics of low hysteresis and eddy current losses, non-aging at high temperatures and satisfactory permeability for transformer construction. When the new steel is substituted for the old, not only is it permissible to use less iron, but the amount of copper may also be reduced while still retaining a very high efficiency.

Transformer cores built of the new steel show not only marked reduction of initial core losses, with corresponding increase in the all-day efficiency, but also freedom from "aging" and consequent lowering of efficiency from the heating of the transformer in operation, which is a weak point of the ordinary sheet steel formerly used in electrical apparatus of this character. Thus the limiting temperature rise is now set by the insulating material rather than by the core material.

Among the companies that have adopted the "alloy steel" should be mentioned the Wagner Electric Manufacturing Company, St. Louis, Mo., which claims to have been the first transformer manufacturers in the United States to employ it.

Wagner transformers are of the oil-cooled type, but oil is not depended upon for internal insulation. All of the customary insulation tests are made upon the transformers, and sustained successfully by them, before adding the oil. The insulation of these transformers is therefore extraordinarily good, since the effective dielectric strength of the oil is added to the already high insulation of the transformer structure due to the excellence of the design.

It is said that in the design of Wagner transformers the attaining of excellent voltage regulation has been given just consideration. That is to say, the copper loss has been kept small, while the magnetic leakage has been minimized. Thus the transformers are particularly well suited for supplying energy to lamps. Regulation is an especially important feature of a good central-station transformer. Moreover, central station managers understand that in order to realize the value of good regulation possessed by the higher-grade transformers installed on their circuits, transformers of poor regulation must be kept away from parallel connection with the latter. Thus, if transformers of poor regulation are connected in parallel with transformers of good regulation, as the load increases the former will, by falling off in voltage, shift a good part of their share of the load on to the latter, which will thereby be overloaded and may even be burned out.

Ground Clamp for Electric Lighting Service.

The Yonkers Specialty Company, manufacturers of the "New York" ground clamp, largely used by telephone companies for making ground connections, has recently placed on the market a modification of its telephone clamp designed to meet the peculiar requirements of electric-light service. A current which must be carried by a clamp of this sort in electric-light service is often quite large, and it is, therefore, necessary to provide a clamp which is both strong mechanically and efficient electrically. These features the manufacturers claim to have embodied in their "Type B New York" ground clamp.

The best ground connections are those made to water pipes or lead-covered underground cables, where this is allowable, as buried copper plates and driven ground rods are often inefficient on account of the varying nature of soil. In making connections to lead water pipes or cable, it is essential that no injury be done to them by the clamp. In the present device it will be noted that the binding post which tightens the clamp does not bear on the pipe, but upon the copper strap, thus protecting the pipe from mechanical injury and at the same time providing a low-resistance ground connection under the bottom of the binding post, and all around the pipe.

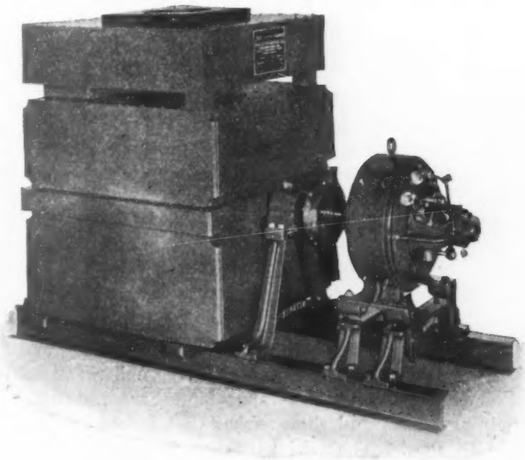
The clamp is easily adjusted to all sizes of pipe. Another convenient feature of the clamp is the binding post attachment for the ground wire itself. The attaching block is bored to fit accurately the various sizes of ground wires actually used, and the mechanical connection is so good that no solder is necessary, although it may be added if desired. A lock-nut is also provided to keep the clamp permanently tight.

GROUND CLAMP.

Motor-Driven Organ Blower.

It has long been recoghized by organists and builders that, for organ blowing, a centrifugal fan is far superior to feeders operated by any new method because of the absolutely steady pressure developed, which greatly enhances the quality and purity of tone of old and modern organs. Until recent years, however, this type of machine could not be used because of the excessive noises of the ordinary fan blower, which was then the only machine of this character on the market.

The "Kinetic" blower, shown in the accompanying illustration, has been designated expressly for organ blowing and is stated to overcome effectually this difficulty. The machine consists of several fans mounted on one shaft, by the rotation of which the required air pressure is generated, each fan adding the pressure developed by itself to that of the preceding fan. These fans are enclosed in a case and the whole mounted on an I-beam base and direct-connected or belted to an electric motor, the motors in all cases being unenclosed. It can be run equally well by either direct or alternating-current motors. No care is required other than filling the oil cups every few weeks.



MOTOR-DRIVEN ORGAN BLOWER.

This machine is made by the Kinetic Engineering Company, Sixtieth Street and Baltimore Avenue, Philadelphia.

Electrical Equipment of the Cleveland Technical High School.

The Cleveland Technical High School is located at the corner of Scoville Avenue and East Fifty-fifth Street, Cleveland, Ohio. The building is a four-story and basement brick structure arranged in the form of the letter E, and it is said that it will be one of the best equipped schools of its kind in the country. The power plant is placed at the extreme rear of the building. The details of the plant and of the heating, ventilating and lighting systems have been carefully worked out by the Cleveland Engineering Company. In the plant are three horizontal tubular boilers equipped with Detroit automatic mechanical stokers and with automatic damper regulators. The stokers are placed with a Dutch-oven setting and special care has been given to the matter of smoke prevention. The stack is 150 ft. high by 4 ft. inside diameter. Single-cylinder Skinner engines are used and these are direct-connected to a 200-kw and a 125-kw Burke three-wire generator giving an e.m.f. of 220-volts between the outer wires. The use of this type of generator eliminates the rotary balancer and the stationary balancing coils and secures the double voltage transmission by and within the armature winding itself. The feed-water heater is of the Webster horizontal cylindrical type, and the two boiler feed pumps are of the Smith-Vaile type.

The heating and ventilating system is a combination of direct radiation and fan ventilation. Power's automatic temperature control is used both on the direct radiation and on the tempering coils of the ventilating system. The ventilating system is designed to supply fresh air to the rooms at a constant temperature of 70 deg. by means of blowers and to remove air from the rooms by exhaust fans. The distributing air ducts are of brick, concrete and galvanized iron, with galvanized iron raisers both for supply and exhaust.

Air is supplied by four steel-plate fans, one with 108-in. and three with 96-in. wheels. Three of these are motor-driven and one is direct connected to a steam engine. The engine-driven fan, located near the power plant, supplies the shops and work rooms. The three motor-driven fans, which are near the center of the basement in the main building, supply the two halves of the main building and the auditorium and gymnasium.

There are three disk fans in the attic, one 96-in. and two 60-in. diameters. These are direct connected to electric motors and are provided with tempering coils, aggregating 24,000 linear feet of 1-in. pipe. Two steel-plate exhausters with 28-in. wheels direct connected to electric motors are provided for special ventilation of the closets, and one cast-iron exhauster with 15-in. wheel direct connected to electric motor furnishes ventilation for the chemistry laboratory. All of the fan motors are controlled by the Cutler-Hammer fan regulators mounted on the switchboard panel in the engine room.

An Otis electric passenger elevator is installed, giving service from the basement to the fourth floor. The shops and machine tools are operated by electric motors—about 15 in number and aggregating 105 hp. All motors for fans, elevators and shop equipment are wound for 200 volts, direct current.

The electric wiring is laid out for a complete Edison three-wire system of distribution for lighting and two-wire system for power purposes, and is divided into 17 circuits. For general illumination 16-cp, 110-volt carbon-filament lamps are used. Special illumination in the auditorium and gymnasium is supplied by 20-cp and 32-cp lamps. In the boiler and engine rooms Cooper Hewitt mercury-vapor lamps are installed. In the draughting rooms and shops either the Nernst or tungsten lamps will be used. The wiring of the draughting rooms is under the floor, and individual lamps are placed in each draughting table, the wiring being brought up from below. Special care and attention have been given to the matter of lighting, both for artistic and effective illumination, as well as for economical distribution and operation.

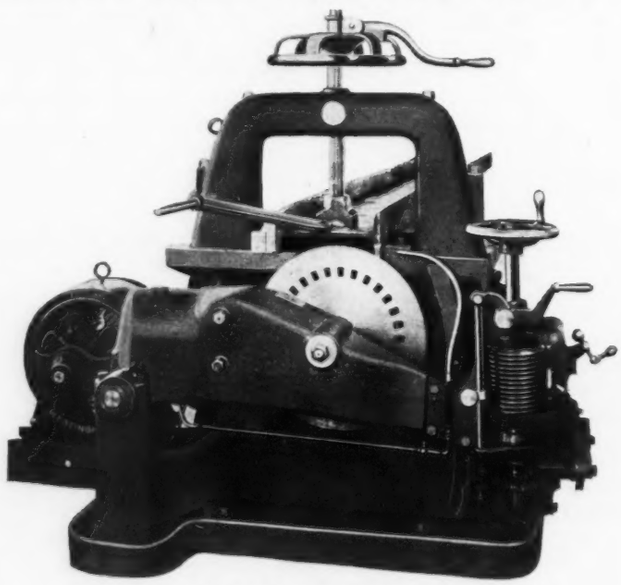
The switchboard consists of five panels, including two generator panels with the necessary switches and instruments, one station panel with provision for taking current readings of all the circuits and with space for storage battery instruments to be installed at a later date. The feeder panel contains the usual feeder switches, and the fifth panel contains the Cutler-Hammer controllers, together with air cocks for operating large dampers at the outlets of the exhaust fans. No pains nor expense have been spared to make the power plant and the heating, ventilating and lighting systems complete in every detail and up to the latest and best modern practice.

Motor-Driven Cold Metal Saw.

The use of small cold saws for cutting off all sizes and shapes of metal work has become very general in a great variety of establishments, not only because of the utility of the saw itself, but also because of the fact that individual motors have been most successfully fitted to the saws. In a great many establishments it would be almost impossible to locate a belt-driven saw so that it could be conveniently used by the workmen. In the average machine shop one or more saws are required in the stock room or some other equally inconvenient place for mechanical drive. On the other hand, the use of a small electric motor on the saw permits the location to be selected without reference to any requirements except the convenience of putting work through. In structural iron works, for example, the self-contained unit of motor and saw can be picked up by a crane and carried to any part of the building or yard, and found similarly advantageous on many plants.

The cold saw illustrated, which is one that does not require a bevel gear, is especially adapted to motor drive. The saw is manufactured by the Lea Equipment Company, of New York City, and is fitted with a Westinghouse shunt motor. The size shown requires a 2½-hp motor and is capable of cutting 8-in. round stock. A Morse silent chain is used to connect the motor to the saw, in preference to gearing, as experiments have shown the former to be more satisfactory.

It is necessary to be able to adjust the speed of the saw in order to cut different metals with maximum efficiency. For instance, experience has shown that the peripheral speed of the



MOTOR-DRIVEN METAL SAW.

saw should be 52 ft. per minute with a very coarse feed for structural iron, machinery steel and metals of this class. For annealed tool steel a lower speed of but 37 ft. a minute is the most efficient. This same speed is also used on Krupp's chrome-nickel steel. In order to obtain these speeds, an adjustable-speed motor with speed range of 1 1/3 to 1 is used, with a speed-controlling rheostat. It is only necessary to move the handle of the controller to obtain any desired speed.

Ammeter Switches.

Very often it is desirable to use a single ammeter for measuring the current in a number of different circuits so as to avoid a multiplicity of instruments. This is possible if shunts are placed in each of the circuits and a suitable switch is used. The Walker Electric Company, of Philadelphia, Pa., has brought

FIG. 1.—REAR VIEW OF 10-CIRCUIT SWITCH.

out two switches for this purpose. One of them is shown herewith. In order that the ammeter switch might not introduce errors in the instrument readings, it is made with a negligible resistance. The contact studs which form the switch terminals are sweated into contact blocks and rings, and are provided with two contact nuts. The switch parts are mounted on stone bases with ample room between contacts so that the switch is

FIG. 2.—FRONT VIEW OF 22-CIRCUIT SWITCH.

serviceable on circuits of 600 volts or less. Two sizes of switch are made: one for 10 circuits and the other for 22 circuits. The smaller switch has a single plate with a double contact arm holding the two brushes. The larger switch is provided with two plates, each having a single contact arm holding one brush. The switches are intended for direct-current circuits.

Silico-Vanadium Steel.

Silico-vanadium steel, which is used exclusively in the transformers made by the Pittsburg Transformer Company, is a high-grade alloy steel possessing high permeability and very low hysteresis loss. As a consequence, transformers made of this material exhibit very low iron and copper losses, and excellent regulation. Owing to unusual characteristics of this metal, upon its adoption it was necessary to make new transformer designs in order fully to avail of its excellent qualities. In fact, it was found that not only was a transformer made up by substituting the new cores for the old style cores, a badly proportioned apparatus, but it was costly as well on account of the high cost of the new alloy steel. The problem therefore was to design a transformer which would show an improved efficiency and at the same time fall within the necessary limits of cost. This has been accomplished without departing from the core-type structure which has characterized Pittsburg transformers for 10 years. In fact, the new designs are far better in every way than the designs which they supersede, in that the new steel has rendered possible a transformer which more fully takes advantage of the superior structural and electrical features inherent in the core type of design. From the outset the company refused to consider designs whose novel forms and grotesque structures were their sole attraction, but determined to develop the core-type Pittsburg transformer until every possible gain was obtained from the new silico-vanadium steel. How well this has been accomplished is shown by various competitive tests made during the past year between Pittsburg transformers and their competitors, of which the following are examples:

In tests made at Bay City, Mich., Aug. 4 and 5, 1908, a 5-kw Pittsburg transformer showed a core loss of 48½ watts, while the nearest competing transformer showed a core loss of 58 watts, which is nearly 22 per cent higher than in the transformer constructed of silico-vanadium steel. The saving in energy due to the use of a Pittsburg transformer, as against the next best, would amount to 81,000 watt-hours per annum for this one transformer alone. In a test in Allegheny, Pa., in February of this year, a 7½-kw Pittsburg transformer showed a core loss of 54 watts. The nearest competing transformer showed a core loss of 81 watts or over 50 per cent higher, again illustrating the great superiority of the silico-vanadium steel. The great superiority of this steel is thus not a matter of theory or laboratory experiment, but has been established by the commercial testing of Pittsburg transformers.

Thermostatic Magnet Protector.

Appreciating the real field which exists for a reliable protective device not dependent upon an electromechanical mechanism, the designers of the thermostatic magnet protector after a long series of tests under actual service conditions, finally adopted the form illustrated herewith as embodying all the desirable features called for in a protective device of this nature.

The construction is clearly shown in the illustration. As will be seen, the device consists of a spring clip mounted on a metal holder and locked in position by means of a small metallic "button." This button is composed of a special alloy, which will melt at a predetermined temperature and in melting releases the spring clip, which instantly opens the circuit and cuts the apparatus, being protected out of circuit—thus preventing a burn-out. This button carries no current and does not act as a fuse, but is dependent for its operation upon the actual temperature of the apparatus to be protected.

The device was primarily designed for the protection of arc-lamp coils and in this field has found its widest application. By

THERMOSTATIC MAGNET PROTECTOR.

placing the protector in series and with magnet coils, it is claimed to be impossible to damage the coils, as the device will always cut the lamp out of service before a dangerous temperature has been reached. It is stated that in one instance where these protectors have been installed, a saving of approximately $3,000 has been effected within one year. The thermostatic magnet protector is being marketed by the Central Electric Company, Chicago.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Trade continues to show some improvement and there are many reports that buying is better and that the wheels of industry are beginning to move more freely. The Government crop report made public Aug. 7 was not as encouraging in some respects as that of July promised, although it showed that in almost every one of the principal crops the yields would be heavier than for the previous year. The only material decrease from the July report was for spring wheat in the Northwest, where unfavorable weather just at the maturing period has done much to reduce the general condition. The decline, according to the figures of the Agricultural Department, is nine points, which in reality amounts to many million bushels. Even with this decline the spring wheat yield will be 30,000,000 bushels in excess of that last year. The winter wheat, which has recently been gathered, and is safe, shows an unusually large harvest, and the corn reports make the crop a bumper one. During the first week in August much needed rains were general over the Central West and the condition of corn was greatly advanced. The total returns from the cotton crop, too, promise to be the best ever made and the minor crops are in excellent condition. All of these things necessarily make for prosperity in the fall and winter, add to the purchasing power of the country and furnish traffic for the railroads. These latter are already beginning to feel some expansion in freights and to report considerable reduction in the number of idle cars. The first of the fall merchants' excursions began the first week in August, and the larger cities have therefore been reporting considerable increase in the jobbing trade. Industrial reports are generally of increased working time for the operatives and enlarged output for the factories. There is practically more doing in the iron and steel trades, in hardware manufacturing, coal mining and in the lumber and building lines. In building, especially, the public has become taught to believe that the low point of the depression has been passed, and that building is now cheaper than it is likely to be again for many years. Reports to commercial agencies indicate that retail stocks are down to very low levels—100 cities and towns showing only about 75 per cent of normal amounts. This means, of course, that replenishing purchases must be liberal, and it is in this theory that jobbers are preparing for a trade that will be even above the average. Internal commerce reports for the month of June, as compared by the Bureau of Statistics of the Department of Commerce and Labor, showed marked improvement over any of the preceding months of the year, and there is every indication that July is far ahead of June. There are many expressions of optimism on the part of financial leaders and the general public tone is one of hopefulness. E. H. Harriman said last week in speaking of the situation: "A more rational feeling prevails throughout the country in the matter of financial conditions. I feel that there is much improvement in the situation. With the crops growing and those already gathered the production in the aggregate will be of greater magnitude and value this year. This is the basis of prosperity. When the farmers sell their crops they will be in the markets to buy and help the merchants and manufacturers." According to *Bradstreet's* report failures for July were 1151, which were up to the average of the preceding five months and have been only exceeded twice in July. The liabilities, $22,315,984, were the heaviest that have been recorded since 1893. For the seven months of 1908 there were 8713 failures in the country with liabilities of $201,098,717. For the week ended Aug. 6 failures numbered 205, against 275 the week previous, 157 in 1907, 137 in 1906, 166 in 1905 and 167 in 1904.

THE COPPER MARKET.

Again has the copper market for the week continued to climb, and again has the buoyant feeling given encouragement to the producers and brought anxiety to the consumer who failed to secure his stock when the price of the metal was below 13 cents. During the week ended Aug. 10, all grades of copper advanced in the American market from 5/8 to 3/4 of a cent, and at the close of that period it would have been hard to purchase any considerable amount of lake or electrolytic for less than 14 cents. The exact reason for the sharp advance in prices and for the strength in sentiment is hard to explain, except on the ground that the market is in the hands of strong and experienced men who can almost do with it what they choose. Statistically there is no logic in the advance or even in the optimistic tone. The production of the American mines is still far more than double the actual consumption. Stocks of copper in Europe are enormous, and even in this country accumulations are becoming serious. During the past month there has been a large increase in the amount of copper normally stocked on the lake docks awaiting shipment. The visible supply in that location now is upward of 10,000,000 lb., and it has not been allowed to accumulate on account of any scarcity of carriers. The Utah output is in excess of any previous record and the production in the Butte district is almost up to normal. The exports to Europe for the month of July were much less than in June, and the exports so far for August are below the average. The local buying, while somewhat improved over the earlier portions of the summer, is still far below the normal and the reports of incoming orders from large consumers does not indicate that it will be much better in the near future. And yet, the illogical market is strong and prices advance. The only explanation is "manipulation." Strong holders have set their price pegs higher and speculators who have confidence in the interests back of the market are willing to take chances and help along the boosting game. In spite of adverse conditions these speculators, in all likelihood, have arrived at the correct conclusion. The interests controlling the market can hold it as long as they choose—could even curtail production in extremity—and in the coming return of industrial activity consumers will be compelled to buy. As yet there is no timidity displayed on the part of the men behind the upward movement. Production goes merrily on and mining concerns are in excellent condition. But for the fact that the Boston & Montana Company was restricted to about 40 per cent of its ordinary output during July, because of the damage done to the smelters at Black Eagle Falls by the earlier floods, the mines of the Butte district would have broken all records in the production of copper last month. With the Boston & Montana so greatly reduced the total production still amounted to 26,409,600 lb., and the Washoe smelter, which produced all the copper except that credited to the Original and Pittsburg and Montana companies, established a new high record of production. All mines are again running full capacity with the exception of those of the Boston & Montana, and several of the new mining companies are preparing to resume operations.

Lake	13¾@14
Electrolytic	13⅝@13⅞
Castings	13⅜@13⅝

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	61 17 6	61 17 6
Standard copper, futures	62 12 6	62 12 6
Market	Strong.	Steady.
Sales of spot	1,400 tons	
Sales of futures	1,700 tons	

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 5 0
London, futures	64 10 0	56 17 0
London, best selected	67 10 0	60 0 0

The quarterly report of the Utah Copper Company for the three months ended June 30, showing earnings for the stock of $493,694, indicated net earnings at the rate of $2.67 per share for the year, but these earnings were based on 12½-cent copper and an average monthly production of 3,850,000 lb. The company is now outputting between 4,250,000 and 4,500,000 lb. per month, and will soon increase this by placing in commission, in its 6000-ton concentrator, two additional sections of 500-tons

capacity each. During the month of July the State of Utah produced 8,500,000 lb. and is now firmly established on a basis of 100,000,000 lb. per year. The London market on Aug. 10 appeared to be a trifle stronger and the effect was an immediate advance on the New York Exchange. Local consumers continued to take hold for immediate needs only, although some of them are undeniably nervous as to what the future may hold in store for them. Exports for the month of August up to Aug. 10 were 6827 tons. Closing prices on the Metal Exchange are given in the accompanying table.

WESTINGHOUSE PATENT SUSTAINED.—Judge Ray, of the United States Court for the Northern District of New York, has granted an injunction—suspending its operation, however, until Nov. 15—to the Westinghouse Electric & Manufacturing Company, restraining the Middleburg & Schoharie Electric Light, Heat & Power Company from using transformers made by the Pittsburg Transformer Company, which, it is alleged, infringe the patent of William Stanley, Jr. Judge Ray says: "The validity and scope of the patent in suit has been adjudicated by the Circuit Court of Appeals in this circuit, in the case of Westinghouse vs. Montgomery. The moving papers disclose that a Pittsburg company made the alleged infringing transformers used by the defendant some six years or so ago. Experts have examined them, so far as they can be examined while in use, and pronounced them an infringement, giving their reasons for the conclusions reached. The complainant also produces before me a transformer or converter made by that company, and purchased of it as one of its regular and standard transformers, kept in stock and sold as such with a label or card thereon stating that it was sold from stock. The complainant says that it was delivered within three or four hours after its purchase. This is not denied. But defendant says it was made that day after being ordered, and was a special transformer made to conform to the particular order given. That it infringes is not denied. I do not credit the affidavits that this was made to conform to a special order after the order was given. I think it was one of the transformers being made and sold by the Pittsburg company, and that in all its essentials it represents the transformers used by the defendant. I think the complainant has made a complete prima facie case of infringement and that defendant has failed to meet or undertake it, having had ample opportunity so to do if it can; however, the defendant is supplying light to a large town and I am not disposed to inconvenience the people or impose a hardship on the defendant. The complainant is entitled to a preliminary injunction, but under all the circumstances and to give an opportunity to appeal and obtain a proper review, the issue and operation of same is suspended until Nov. 15, 1908. This will give time to change the transformers in use if that course is thought wise."

ALTERNATING CURRENT HOISTS.—The Hedden Construction Company, general building contractors, who have erected some of the largest office buildings in New York City, and who are now engaged in the construction of the Metropolitan tower, Madison Square, New York City, the tallest office building in the world, has recently placed an order for 16 hoisting machines equipped with two-phase alternating current motors. For some time past the Hedden people have been using steam hoists on their operations, but with a view to obtaining a hoist which would be easily portable, and economical both in space and cost of maintenance, they investigated the various types of hoists now on the market, with the result that the alternating current hoists were chosen. The general availability of alternating current throughout the United States was an important factor in determining the choice. These hoists will be first used on the new 14-story office building about to be erected on the site of the old Fifth Avenue Hotel. The Hedden company has already made a contract with the United Electric Light & Power Company, of New York City, for the supply of two-phase current of 800 hp to the hoists for this job, as well as 150 arcs and 2000 incandescent lamps to be used during building operations. Following the use of the hoists on the Fifth Avenue Hotel building they will be transported to Newark for use on the new building of the Prudential Insurance Company to be constructed by the Hedden company.

OTIS ELEVATOR COMPANY REPORTS BUSINESS IMPROVEMENT.—In speaking of the business situation, Mr. William D. Baldwin, president of the Otis Elevator Company, says: "The trade shows an improvement, which, however, is somewhat moderate, but nevertheless healthy and encouraging. Reports obtained from our representatives in practically all of the large cities of this country and Canada show that a gradual improvement is being maintained, but nothing like last year's volume of business is in evidence. The volume of the company's sales is about three-quarters of the normal. This comparison is based on the results of 1906 rather than on last year's, as the former is the fairer standard, 1907 being an exceptional year. The improvement in business, though not large, is very generally distributed throughout the country. The increase in sales holds good for all sections of the United States, although in some localities the demand for the future is not as promising as it was some time ago."

GROWTH AT ZANESVILLE, OHIO.—Mr. H. H. Sturtevant, of Zanesville, Ohio, proprietor of the largest department store in southeastern Ohio, recently placed a contract with the Ohio Electric Railway Company for a complete installation of Westinghouse-Nernst lamps to replace electric arcs. This was at once the first order for the new units to be placed in the Cincinnati territory of the Nernst Lamp Company, and the first fruits of the new business-getting campaign of the Ohio Electric Railway Company. Mr. N. C. Draper, the new manager of the Zanesville division of the Ohio Electric Railway Company, has started in with the intention of making substantial old Zanesville a modern electric city.

GENERAL ELECTRIC EQUIPS THIRD AVENUE CARS.—The 150 new cars ordered by the Third Avenue Railroad Company from the J. G. Brill Company, of Philadelphia, are to be furnished with motors, controllers and all electrical equipment by the General Electric Company. The order has just been placed for 300 65-hp motors, two for each car, and for all other necessary equipment. This order makes 325 full car equipments which have been purchased from the General Electric Company by the Third Avenue Railroad Company since it went into the hands of a receiver last year.

PAY-AS-YOU-ENTER CARS IN ST. LOUIS.—The United Railways Company, of St. Louis, has made arrangements to install 110 pay-as-you-enter cars. A portion of these will be new cars and the others will be reconstructed. The work will all be done in the shops of the company in St. Louis. It is expected that an additional order for this type of car will be placed in the fall.

LOWELL ELECTRIC LIGHT BUYS EQUIPMENT.—The Lowell Electric Light Corporation, of Lowell, Mass., has contracted with the Stone & Webster Engineering Corporation for the purchase of a complete stoker equipment, a second stage feed water heater, turbine ventilation and various minor equipment to be installed by the contractors in the new 3000-kw station at Lowell which has been built recently.

THE ECONOMICAL ELECTRIC LAMP COMPANY, 96 Warren Street, New York, announces that it has purchased the copyrighted trademark "Hylo" and all patents on Hylo lamps, which type adds to its former line of "pull-string," "turn-bulb" and "long-cord" turndown lamps.

Financial Intelligence.

THE WEEK IN WALL STREET.

The total sales of stocks for the week ended Aug. 8 were 4,912,972 shares, which is the high record for the year, even exceeding by a few thousand shares the week ending July 25, which was the last period of activity and advancing prices. Substantial gains in prices were recorded in every one of the active stocks except Pennsylvania, and in that the decline was only fractional. As in the case of the other little flurries which have marked the general advance movement which has been in evidence since May prices were pushed a little higher than before, and in most instances top figures for the year were reached. Another thing that is worth mentioning in connection with the existing condition is the fact that prices at the present time, for almost every important issue, are higher than they were one year ago. Amalgamated is eight points higher; American Smelting, four or five; Brooklyn Rapid Transit, six points; Great Northern, 17; National Lead, which has developed into a market leader, 39 points; Northern Pacific, 23; Reading, 36; Southern Pacific, 13; Union Pacific, 30, and Steel common, 16. All of which goes to show that the stock market is not in reality in bad shape, that prices are healthy and that all that is needed to furnish pyrotechnics is a return of public

buying. Another thing that is worth remembering is that there are no special boom news features to stimulate the market. There is no great rush of prosperity, no big combines or promotions, no startling dividend advances, no reports of great earnings. On the contrary, the return to even normal business conditions is annoyingly gradual, the resumption of industrial activity is in sight, but its coming seems tediously slow to the workman waiting for employment and to the stockholder waiting for dividends, the railroads continue to report distressing decreases in gross receipts compared with last year. And yet stocks continue strong and the slightest activity in trading sends prices racing upward. Specifically as to the past week, the one news feature was a government crop report that was the most discouraging issued during the summer months. The condition of spring wheat was recorded as being nine points below the condition figured out in the July report, and this shortens the crop estimate by several million bushels, and, had the trend of sentiment in Wall Street been pessimistic, would have been seized upon as a pretext for pounding prices. Instead of this the most active day and top records for prices followed immediately the publication of the report. The Street knew that in spite of the deterioration in the condition of spring wheat the aggregate yield from all crops would be the largest ever recorded, and that at prices prevailing at present the return in money to the producers would be many millions ahead of anything ever known. With the farmers already in good financial condition, the promise is that they will have more money to invest in securities or in luxuries than ever before in the country's history. Money continues to be plentiful and easy in both this country and Europe. Call rates are from 1 to 1¼ per cent, and during the week loans were recorded at ¾ per cent, the low mark of the year. Time money is in little demand at figures that have prevailed for the past two months, 2 to 2½ per cent for 90 days. The general buoyant feeling which had marked the closing days of the preceding week continued on Aug. 10, and almost all of the active stocks recorded advances. The quotations in the table are the close on Aug. 10:

NEW YORK.

	Aug. 3	Aug. 10	Shares Sold.		Aug 3.	Aug. 10.	Shares Sold.
All.-Ch.	11¼*	11⅜	1,800	Int. Met., com..	11½	13⅛	13,220
All. Ch., pfd..	34*	35¼	3,925	Int. Met., pfd..	32⅛	37	25,510
Amal. Cop....	78¼	82⅞	254,485	Mackay Cos..	69¾	69½	510
Am. D. T.....	39*	39*	——	MackayCos.,pfd	69¾	69	110
Am. Loc	56¼	58	42,550	Manhattan Elev	138¾	—	710
Am. Loc., pfd.	107	109	300	Met. St. Ry...	30*	40½	200
Am. Tel. & Cbl	64½*	64½*	——	N.Y. & N.J.Tel	112*	114½*	50
Am. T. & T...	121⅛	122	5,100	Steel, com....	44⅞	48	489,200
B. R. T.....	52¾	56¾	143,575	Steel, pfd....	109½	110¼	69,650
Gen. Elec. ...	146¾*	146½	2,827	W. U. T.....	55½	57¾	2,334
				West'h, com..	78¼	76	5,220
				West'h, pfd...	95½*	95	500

PHILADELPHIA.

	Aug. 3	Aug. 10	Shares Sold.		Aug 3.	Aug. 10.	Shares Sold.
Am. Rys.....	44	45	——	Phila Elec....	9⅞	10	——
Elec. Co. of A	10	10⅛	——	Phila R. T....	15¼	14¾	——
Elec. Stor. B'ty	39	39¼	——	Phila Traction	90½	89	——
E. S. B'ty, pfd	49*	49	——				

CHICAGO.

	Aug. 3	Aug. 10	Shares Sold.		Aug 3.	Aug. 10.	Shares Sold.
Chi. City Ry..	176½	176½*	——	Met. El., com.	15*	15	——
Com. Edison..	102	101¾	——	Met. El., pfd..	48	47½	——
Chi. Subway..	21*	23	——	Nat'nal Carbon	70*	70*	——
Chi. Tel. Co..	139½	143	——	Nat. Carb., pfd	110	109	——

BOSTON.

	Aug. 3	Aug. 10	Shares Sold.		Aug 3.	Aug 10.	Shares Sold.
Am. Tel. & Tel	121½	122¼	——	Mass. E. R., pfd	50	49*	——
Comb'ind Tel.	109½	—	——	Mex. Tel., pfd.	6*	6*	——
Gen. Elec....	146¾	145⅛	——	N. E. Tel'p....	114*	103	——
Edison El. Ill.	216*	214½	——	W. Tel. & Tel.	6*	6*	——
Mass. Elec. Ry.	10¾*	10¼	——	W. T. & T. pfd	70*	70	——

*Last price quoted.
Shares sold are for week Aug. 3 to Aug. 8.

HUDSON RIVER ELECTRIC POWER BONDHOLDERS.—Many of the holders of the $4,025,000 5 per cent bonds of the Hudson River Electric Power Company have entered strenuous objection to the plan proposed by President Ashley that they surrender their coupons for the next four years and accept 6 per cent notes to be secured by the surrendered coupons. In order to take care of their interests the bondholders have met and organized a protective committee. The committee is composed of John A. Young, president of the Windsor Trust Company of New York; James C. Chaplin, vice-president of the Colonial Trust Company of Pittsburg; Harlan W. Wipple, president of the Central Trust & Savings Company of Philadelphia, and Le Roy W. Baldwin, president of the Empire Trust Company of New York. Parker, Hatch & Sheehan and Rollins & Rollins, of New York, and J. H. McNeal, of Philadelphia, are counsel for the committee, and Winthrop E. Scarritt, of New York, is secretary. Circulars have been sent out and bondholders have been appealed to through newspaper advertisements declaring that since the interest due Aug. 1 has been defaulted united action on the part of the bondholders is necessary. The Windsor Trust Company of New York, Colonial Trust Company of Pittsburg, City Trust Company of Boston and West End Trust Company of Philadelphia are named as depositaries. Deposits must be made before Sept. 1. The bondholders claim that the proposition of the company is a very unusual one, in that it uses the coupons which already belong to the bondholders as collateral for loans from the bondholders. They also argue that the plan proposes taking the money which belongs to the bondholders to pay floating debts which are properly charged against the stockholders.

SECOND AVENUE BONDHOLDERS FORM COMMITTEE.—Under a call issued by Mr. John W. Castles, president of the Guaranty Trust Company, of New York, a protective committee of the bondholders of the Second Avenue Railroad Company, of New York City, has been formed. The committee is composed of Mr. John W. Castles, chairman; Mr. Henry S. Redmond, Mr. G. G. Haven, Jr., and Mr. John W. Hamer. Mr. Alexander J. Hemphill, of the Guaranty Trust Company, is secretary of the committee, and the counsel is the firm of Davies, Stone & Auerbach, New York City. The interest on the bonds due Aug. 1 has been defaulted, but it is expected that the receivers of the Metropolitan Street Railway Company will soon ask the court for instructions to pay these coupons. If permission is not granted a deposit agreement for the bonds will be prepared. The Second Avenue Railroad Company's property was leased to the Metropolitan Street Railway Company in 1898 for the length of its corporate existence, and there are $5,631,000 first consolidated mortgage 5 per cent bonds outstanding. Under the terms of the lease to the Metropolitan not only the bonded debt was guaranteed, but 9 per cent on the capital stock of the road, of which there is $1,862,000 outstanding. The Second Avenue Railroad's total issue of bonds, stock and notes is $8,862,000, of which $8,755,000 was owned by the general public. So far the receivers of the Metropolitan have met the rental payments on the stock on which the last quarterly installment is due Sept. 1.

CHICAGO CONSOLIDATED BONDHOLDERS SEEK SUPPORT.—The protective committee of 4½ per cent bondholders of the Chicago Consolidated Traction Company, of which William F. Harrity is chairman, has sent out a circular urging bondholders to deposit with it instead of with the rival committee, of which J. N. Wallace, president of the Central Trust Company of New York, is chairman. The circular says that the Harrity committee is composed of "actual bondholders" and continues: "We have no controversy with the Wallace committee; but it is not unfair to say that a committee of bondholders, not in any way connected with the Chicago Railways Company, is in a position to speak for the bondholders better than a committee composed of gentlemen who are not bondholders in their own right, and are in part the officers and directors of the Chicago Railways Company, believed to be liable for said bonds." The principal, if not the only, support given to the Wallace committee is by the banking interests and bankers that hold the Charles T. Yerkes bonds as collateral for loans made to him in his lifetime. It is alleged that the Wallace committee was organized in the interest of the Chicago Railways Company, the successor company to the Chicago Union Traction Company.

NEW BEDFORD ANNUAL REPORT.—The annual meeting of the New Bedford (Mass.) Gas & Edison Light Company was held on Aug. 3, President George B. Stetson in the chair. The report submitted by Mr. Charles R. Pierce, the treasurer, showed that dividends of 10 per cent had been paid in four quarterly dividends of 2½ per cent. The company paid also an extra dividend of 1½ per cent on its mercantile work, from sales of gas stoves, shades, fixtures, etc. There was also a dividend of 20 per cent, payable July 15, as a division of deferred profits, this being a portion of the investments in plant taken from the earnings of the company during the past few years. The old officers were re-elected. The company is now putting in a 500-hp gas engine with producer, etc.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY.—Engineers acting jointly for the Massachusetts Highways Commission and the New England Telephone & Telegraph Company, are making a detailed physical inventory of the property of the company. This work is done with the view of mapping out a system of rates based on the valuation of the plant. The inventory will not be completed until fall, but the officials of the company express confidence that the valuation will be found to be considerably in excess of the $31,000,000 stated in the Dec. 31 balance sheet. The operating departments of the company are to be operated on a new plan hereafter. Although there will be no important changes in the personnel the company will be operated under three divisions, the commercial, the plant and the traffic departments. The commercial department has to do with all the relations with the public, the making of contracts and the collection of revenue; the plant department will supply and maintain the facilities for doing business; and the traffic department will direct the giving of service. Mr. C. T. Keller, formerly assistant general manager, becomes general commercial superintendent, Mr. George H. Dresser, formerly general superintendent, becomes general plant superintendent, and F. P. Valentine, traffic engineer, becomes general traffic superintendent. Mr. I. O. Wright, superintendent of the Boston division, becomes assistant general plant superintendent, and Mr. J. H. Barry, formerly superintendent of the central division, becomes division superintendent for the commercial department of the Boston and southern Massachusetts division.

STROMBERG-CARLSON TELEPHONE.—Mr. W. Roy McCanne, secretary and treasurer of the Stromberg-Carlson Telephone Manufacturing Company, has just issued a condensed balance sheet as to the condition of the company on June 30, but dated Aug. 6. This statement shows the amount of capital stock outstanding to be $3,000,000, instead of $6,000,000 as heretofore, caused by the return to the treasury of the company of common stock, par value $3,000,000. The assets have been correspondingly reduced by eliminating "good will and patent account," $1,716,514, and by creating reserves to cover the depreciation of buildings, equipment and merchandise, and unascertained losses on accounts receivable, notes receivable and investments. The values shown for real estate, plant, etc., $1,295,984; merchandise in hand and in process, $1,027,152, are the appraised or cash cost values, less depreciation reserves. The assets also included $150,143 in cash; $2,073,913 accounts and notes receivable and investments, and $421,467 liability on two-year notes of the U. S. Independent Telephone Company. Among the liabilities were $80,000 real estate mortgage on Chicago property; $920,000 notes payable, and $21,045 other liabilities. With total assets of $4,129,914, a surplus was shown of $108,869. Hereafter the board of directors will submit such statements annually to the stockholders, certified by public accountants.

MASSACHUSETTS ELECTRIC COMPANY'S EARNINGS INCREASE.—For the first nine months of its fiscal year the earnings of the Massachusetts Electric Companies show a very satisfactory increase. Gross earnings showed an increase, while the expenses were slightly less. The net earnings were $1,665,598, as compared with $1,476,709 for the same period of 1907. The surplus for the nine months was $298,654, an increase of $117,887 over the surplus in the same period of 1907. The operating efficiency of the subsidiary companies has been greatly increased and the physical condition of the properties is better now than at any other time since the formation of the holding company. Since 1899 the total expenditures for betterments have amounted to $16,360,000.

MANHATTAN RAILWAY COMPANY BONDS OFFERED.—An issue of $4,500,000 4 per cent gold bonds of the Manhattan Railway Company has just been made by Redmond & Company, N. W. Harris & Company and Moffat & White. These bonds are part of the $10,818,000 authorized to retire the 6 per cent bonds which fell due July 31. The new bonds are offered to subscribers at 96½. The 4 per cent bonds are now a first mortgage upon the entire property of the company, which is paying regular dividends of 7 per cent per annum on its $60,000,000 capital stock. Through the refunding of the first mortgage 6 per cent bonds the company effects a saving of $180,000 in its fixed charges, so that it is now earning at the rate of more than four times its entire interest charges.

WESTCHESTER LIGHTING COMPANY BONDS.—A sale was recently made on the New York Stock Exchange of $60,000 Westchester Lighting Company's 5 per cent bonds. The prices ranged from 101½ to 104. This is the first appearance in the market of these bonds since early in 1907, when they were traded in actively. The Consolidated Gas Company acquired control of the Westchester Lighting Company from the United Gas Improvement Company, of Philadelphia, in 1904. The Westchester company's issue of first mortgage bonds is authorized to the amount of $10,000,000, of which $5,916,000 are outstanding in the hands of the public. They are secured by first mortgage on the entire property and franchises of the company.

PHILADELPHIA RAPID TRANSIT DEFICIT LESS.—For the fiscal year ended June 30, 1908, the gross earnings of the Philadelphia Rapid Transit Company were $18,228,000, compared with $18,095,593 in the previous year. The deficit for the year was only $92,048, compared with $364,048 the year before. The number of passengers carried during the year were 512,869,023, an increase of 20,731,985. The average fare received per passenger was lower than ever before, being 3.55 cents. When the Union Traction began operations in 1897 the average fare received was 4.55 cents. There has been a steady decline in the average rate every year.

BERKSHIRE STREET RAILWAY SEEKS EXTENSION.—The Berkshire Street Railway Company, a subsidiary of the New York, New Haven & Hartford Railroad Company, has petitioned the Massachusetts Railroad Commission for permission to issue $80,000 additional capital stock—$40,000 for extensions in Pittsfield and $40,000 for improvement of line from North Adams to Williamstown. The company petitioned April 28, 1908, for $285,000 additional stock, upon which no action has yet been taken by the commission, which, with the $80,000 now asked for, would make $365,000 new stock.

TAZEWELL (VA.) YEARLY REPORT.—The Tazewell (Va.) Street Railway Company shows gross earnings of $8,323 and operating expenses of $6,008, leaving a surplus for the year of $2,314. The company has made no changes during the year and has paid no dividends. The Tazewell Electric Light & Power Company, controlled by the railway company, reduced its indebtedness $3,500 during the year, a considerable portion of the amount being furnished out of funds of the railway company. Mr. W. T. Gillespie is treasurer.

REPORTS OF EARNINGS.	Gross earnings.	Operating expenses.	Net earnings.	Charges.	Surplus.
Illinois Traction Company, year, 1907	$3,779,187	$2,065,424	$1,650,699	$1,187,584	$453,115
year, 1906	3,013,107	1,602,601	1,361,925	.....	.....
Chicago Railway Company, May, 1908	902,482	600,353	302,183	.....	.....
May, 1907	892,183	598,691	293,492	.....	.....
Mexican Telephone & Telegraph Company, March 1 to May 31, 1908	93,194	51,482	41,712	.....	.....
March 1 to May 21, 1907	98,950	54,897	44,053	.....	.....
Manufacturers' Light & Heat Company, Pittsburg, Jan. 1 to June 30, 1908	2,492,522	964,298	1,528,254	546,483	981,771
Jan. 1 to June 30, 1907	2,607,030	803,010	1,803,120	411,990	1,391,130
Chicago Telephone Company, Jan. 1 to June 30, 1908	4,188,844	2,696,918	1,491,926	87,435	1,459,445
Jan. 1 to June 30, 1907	4,180,909	3,022,570	1,158,339	63,321	1,185,244
Lexington (Ky.) & Interurban Railways Company, Jan. 1 to June 30, 1908	54,983	33,375	21,608	.....	.....
Jan. 1 to June 30, 1907	45,474	30,964	14,510	.....	.....
Lake Shore Electric Railways Company, Cleveland, June, 1908	78,827	43,644	35,183	25,893	9,290
June, 1907	83,554	44,953	38,601	24,467	14,134

GENERAL NEWS

Construction News.

BREWTON, ALA.—Plans are being considered to change the municipal electric light plant to a 2300-volt, 60-cycle, three-phase system, installing a 100-kw plant in duplicate. James S. Sheffield is superintendent.

GADSDEN, ALA.—The Etowah Light & Power Company, of Attalla, Ala., has applied to the City Council for a franchise to erect transmission lines through the streets of the city to furnish electricity for lamps and motors in Gadsden. The company has a large plant on Big Wills Creek, near Gadsden.

RUSSELLVILLE, ALA.—Contracts for the construction of the municipal electric light plant and water works system will be awarded Sept. 1. Prof. Edgar B. Kay, of Tuscaloosa, Ala., is engineer in charge.

WYNNE, ARK.—Plans are being considered to double the output of the municipal electric light plant and change the system from direct to alternating current. F. E. Leonard is manager.

FRESNO, CAL.—Estimates have been prepared by City Engineer Hoxie for lighting the business section of the city, using electroliers in place of the arc lamp posts now in use. The plan calls for 308 lamps at an estimated cost of $38,500, exclusive of the wiring, which will cost about $7,700, making a total expenditure of $46,200.

MERCED, CAL.—The Yosemite Dredging & Mining Company has decided to install a power plant to operate its mines and machinery.

OAKLAND, CAL.—The Board of Supervisors has granted permission to A. W. Maltby and Joseph Naphtaly to operate an electric railway through the Alameda County part of the Alameda-Contra Costa tunnel, back of Claremont.

REDDING, CAL.—Notice of appropriation of 100,000 cu. in. of water in Fall River has been filed by Scott Arthur. The project involves the construction of a large power plant for the generation and distribution of electricity.

SAN FRANCISCO, CAL.—The officials of the United Railroads are negotiating with the Stanislaus Power Company with a view of entering into a long-term contract, whereby the power company is to furnish the United Railroads with electrical energy for operating its railway system. The plant of the Stanislaus Power Company is located at Vallicita, and is capable of generating 36,000 hp. Charles N. Black is general manager and vice-president of the United Railways.

WASHINGTON, CAL.—The claims of the Giant King properties, near Washington, have been transferred to the Washington Mining & Milling Company. The new owners have decided to erect a large electric power plant on the South Yuba River, just below Washington.

COLORADO SPRINGS, COL.—The Denver & South Platte Railroad Company has awarded the contract for the construction of its proposed electric railway from Littleton to Roxbury Park, to W. J. Coursin, Pittsburg, Pa.

FORT MORGAN, COL.—Plans are being prepared for improvements and extensions to the municipal electric light and water plants, which will involve an expenditure of about $55,000. The equipment required will include a four-valve engine direct connected to a 100-kw, alternating-current, 60-cycle, two-phase, 2200-volt generator, together with exciter, switchboard and other accessories.

DANIELSON, CONN.—Work has commenced on the construction of the dam and power house for the Danielson Cotton Company on the Quinebaug River about five miles from Danielson. The dam will be 250 ft. long and 12 ft. high. Electricity will be transmitted to Danielson and will be used to operate the machinery in the new addition to the company's mill now under construction.

DARIEN, CONN.—The citizens of Darien and Noroton are considering the establishment of an electric light plant to be owned and operated by the two towns in common. A committee has been appointed to investigate and make a report on the matter. Connell, Sykes & Connell, of New York, N. Y., engineers, are making preliminary surveys.

WILLIMANTIC, CONN.—The contract for the construction of the Willimantic and South Coventry electric railway has been awarded to Lathrop & Shea, of New Haven, Conn. The railway will run from Willimantic to Lake Wamgumbaug, a distance of about six miles.

JACKSONVILLE, FLA.—Bids will be received by the Trustees for the Water Works and Improvement Bonds of the City of Jacksonville, until Sept. 4, for furnishing all material and equipping the boilers of the city electric light station and the water works pumping station with automatic underfeed stokers to burn bituminous coal of either high or low grade economically and without smoke. The equipment of each plant to be complete in itself. The electric plant contains seven boilers aggregating 2468 hp and the water works plant three boilers having a total rating of 750 hp. For specifications and other information apply to R. N. Ellis, superintendent.

ASHBURN, GA.—The city has decided to establish an electric light plant and water works system, bids for the construction for which will be received until Aug. 12. J. B. McCrary & Company, of Atlanta, Ga., are engineers. John J. Story is city clerk.

VALDOSTA, GA.—The Valdosta Ice & Manufacturing Company is planning to change its system to 60 cycles. B. W. Bentley is vice-president and manager.

MACKAY, IDAHO.—The Lost River Light & Power Company is planning to erect a hydro-electric plant on Cedar Creek near Mackay to furnish electricity for lamps and motors in Mackay and large copper mines in that vicinity. The transmission line will be 10 miles in length and will have a voltage of 11,500, which will be raised later to 23,000. The equipment of the plant will include two sets of high-speed turbines operating under a head of 245 ft. direct connected to generators. A pipe line 700 ft. in length will be built. R. L. Rockwell, of Ontario, Ore., is manager and has charge of the construction of the plant. W. J. McConnell, of Boise, Idaho, is president.

POCATELLO, IDAHO.—The Idaho Consolidated Power Company is planning to install a 1000-kw unit at its plant in American Falls, and may extend its transmission lines. W. F. Murphy is manager.

REXBURG, IDAHO.—It is reported that T. M. Hodgins, of Butte, Mont., has purchased the plant and holdings of the Rexburg Light & Power Company, of which James H. Brady, president of the Idaho Consolidated Power Company, of Pocatello, Idaho, is principal owner, the consideration being $25,000. Mr. Hodgins will establish a 24-hour service.

AVA, ILL.—W. C. Dean, owner of the Ava electric light plant, would like to receive estimates on the cost of installing a five-ton ice plant.

CHARLESTON, ILL.—The Coles County Telephone & Telegraph Company is making arrangements to install a new telephone system in this city at a cost of about $50,000.

CHICAGO, ILL.—Bids will be received until Aug. 26 by the City of Chicago, for the sale of a 700-hp Westinghouse compound condensing engine and accessories. Bids should be addressed to William A. Coleman, B. A., City Hall, Chicago, Ill.

COLCHESTER, ILL.—The Colchester Electric Light & Power Company contemplates installing a new boiler in its plant. Roscoe Wear is superintendent.

EARLVILLE, ILL.—Durrell & Kennedy, owners of the Earlville electric light plant, have rebuilt a good part of their transmission lines and are planning to furnish an all-night service.

FORRESTON, ILL.—George M. Crombie, owner of the local electric light plant, writes that he will install a new 35-kw, 2200-volt, 60-cycle generator with transformer to step up the voltage to 6600 to furnish electricity for lamps and motors in Adeline, Ill., five miles distant.

MILLSTADT, ILL.—A new 175-kw, alternating-current generator is being installed in the municipal electric light plant to take the place of the direct-current arc machine. George P. Hankammer is manager.

WATERLOO, ILL.—Arrangements have been made by the city to move the municipal electric light plant to the site recently purchased on West Third Street. Two 72-in. x 16-ft. high-pressure, return-tubular boilers will be installed at the new site.

WINSLOW, ILL.—W. B. Bucher, of Martintown, Wis., has been awarded the contract for lighting the streets of Winslow with electricity for a term of 20 years. Work will soon commence on the installation of the system.

AUBURN, IND.—The Home Telephone Company is making arrangements for the extension of its telephone lines to Corunna and Waterloo, and other improvements are also contemplated to the system.

ODON, IND.—The Odon Telephone Company contemplates erecting a number of new telephone lines in Epsom and Montgomery.

ATLANTIC, IA.—E. T. Archer, Kansas City, Mo., is preparing plans for an addition to the municipal electric light plant. T. E. Nichols is city clerk.

BOONE, IA.—Plans have been completed by the Boone Engineering & Architectural Company for a telephone building, which will be equipped with a new automatic system. A gas engine will be installed in connection with the electric service. The cost of the building and equipment is estimated at $100,000.

ELMA, IA.—The municipal electric light plant, which was destroyed by fire last December, has been rebuilt. The system has been changed from direct to alternating current; flat rates have been discarded and meters installed. Frank Gue, Jr., is manager.

MANCHESTER, IA.—The Delaware County Telephone Company will erect additional telephone lines.

ORANGE CITY, IA.—The plant and holdings of the Orange City Electric Light Company has been purchased by P. Kooyman, of Orange City.

SIDNEY, IA.—The Sidney Light, Heat & Power Company has been granted a franchise to construct an electric light plant in Sidney. T. E. Newby is city clerk.

ATCHISON, KAN.—The General Electric Company, of Schnectady, N. Y., has been awarded the contract for remodeling the municipal electric light plant, at a cost of $30,000. Fred Giddings is city engineer.

JEFFERSONVILLE, KY.—The Independent Telephone Company, of this city, is planning to extend its telephone line from New Washington to Hanover.

LEBANON, KY.—T. M. Estes, who recently secured a franchise in this city, is planning to install a new telephone system. The new system will establish connections with other independent lines.

PINEVILLE, KY.—Plans are under way for the construction of an electric railway from Pineville to Straight Creek, a distance of about nine miles. N. R. Patterson, William Burchfield and B. R. Smith, all of Pineville, are interested in the enterprise.

MT. STERLING, KY.—The capital stock of the Mt. Sterling Water, Light & Ice Company has been increased from $250,000 to $290,000.

EASTPORT, ME.—The American Can Company is installing an electric power plant to operate the machinery in its plant by electricity.

ELLSWORTH, ME.—The new power house of the Bar Harbor & Union River Power Company was struck by lightning July 30, the lightning burning out the armature and field coils of a new 1500-hp generator, and causing a loss of about $5,000.

NORRIDGEWOCK, ME.—The Kennebec Farm & City Telephone Company will extend its telephone lines into Waterville and Sidney.

PEMBROKE, ME.—The plant of the Pembroke Power Company, which was destroyed by fire last spring, will be rebuilt, work on which will begin at an early date. Electric service is now being supplied from the Eastport plant.

PORTLAND, ME.—The Portland Railroad Company has been granted permission by the State Railroad Commissioners to extend the Cape Shore Electric Railroad from South Portland Heights to the Ocean House.

SQUIRREL ISLAND, ME.—The citizens have voted to authorize the Selectmen to make investigations in regard to lighting the streets of the town by electricity and report at the next annual meeting.

BOONSBORO, MD.—The Antietam Electric Light & Power Company has engaged Orville Shifler, of Hagerstown, Md., as architect for its power plant to be located on Antietam Creek. The company was recently awarded a contract to furnish the city with electricity for lamps for a term of ten years. H. L. Moser, of Hagerstown, is secretary and treasurer.

BOSTON, MASS.—Plans are being prepared for the construction of a large industrial plant on the water front in South Boston for which bids for equipment will soon be asked, including coal handling apparatus, boilers of 2000 hp for heating, pipe and fittings for steam, gas, water and compressed air; fire, boiler feed and elevator pumps; 1500-ft. steam-driven air compressor; gas engines of 2000 hp, with suction producers, direct connected to alternating-current generators, etc. The entire plant will cost about $10,000,000. H. L. Gilman, 26 Linden Place, Brookline, Mass., consulting engineer, is preparing plans for the plant.

CHARTLEY, MASS.—The Board of State Gas and Electric Light Commissioners has authorized the Norton Electric Light & Power Company to issue $5,000 in capital stock. The company was organized in May, 1908, for the purpose of constructing a distributing plant to furnish electricity for lamps and motors.

DANVERS, MASS.—The Electric Light Commissioners are advertising for bids for a new boiler and engine for the municipal electric light plant, for which an appropriation was made recently by the town.

FALL RIVER, MASS.—The American Printing Company, of Fall River, owned by Mr. M. C. D. Borden, has begun work on the addition to its power plant. A new boiler equipment, a chimney 175 ft. high, and two electric generating units will be installed. The plant has spread over so much territory in the past few years that the new electrical installation can be used much more efficiently than shafting and belting.

FITCHBURG, MASS.—The Board of Mayor and Aldermen has granted the petition of the Connecticut River Power Company for permission to erect its high-tension 66,000-volt wires across the highways in Fitchburg, and also to erect transmission lines of 6600 volts from its transformer station on Beech Street for the distribution of electricity to the different mills which have contracted with the company for electrical energy to operate their plants.

HOLYOKE, MASS.—The William Skinner Manufacturing Company has awarded the contract for the construction of a 14-story mill on the south side of its Dwight street mill. The company will also erect a power plant and coal pocket, which will furnish electrical energy for operating the new mill and the Bond Street mill.

HUBBARDSTOWN, MASS.—William H. Bowdlear, of Hubbardstown, has applied to the Selectmen for a franchise to erect and operate an electric light plant in this town.

NEEDHAM, MASS.—The Newton & Boston Street Railway Company has been granted a franchise by the Selectmen of Needham for an extension of its system to Needham Junction station.

MALDEN, MASS.—The Malden Electric Company is replacing the incandescent street lamps with tungsten lamps. The contract calls for 1150 lamps, of which about 200 have been placed.

NORTH ABINGTON, MASS.—Transformers are being installed at the local plant of the Electric Light & Power Company of Abington and Rockland, preparatory to taking electrical energy from the power plant at East Bridgewater. The local plant will not be entirely abandoned. The company is making arrangements to extend its service to Assinippi and West Norwell.

SPRINGFIELD, MASS.—The new building of the Phelps Publishing Company, of Springfield, is rapidly approaching completion. The building contains an extensive electric power plant in the basement to supply the tenants with electricity for lamps and motors.

TAUNTON, MASS.—The committee on street lights has decided to extend the street lighting system to North Taunton. The cost of the extension is estimated at $8,000.

WILLIAMSTOWN, MASS.—A complete electrical plant has been installed by Dr. S. L. Lloyd in his bottling works at Sand Springs.

ALMA, MICH.—The Alma Grain & Lumber Company will install a new 150-kw generator in its electric light plant.

BROWN CITY, MICH.—Plans are being made to install an additional engine and dynamo in the municipal electric light plant. A. Clemens is manager.

GREENVILLE, MICH.—The Greenville Gas, Electric Light & Fuel Company will make some improvements to its generating station this fall.

GREENVILLE, MICH.—The city of Greenville will soon have another electric light plant furnishing electricity for lamps and motors in the city. The plant which is now under construction is owned by the R. J. Tower Electric Company and will be completed in October. Power for operating the plant will be obtained from the Black River. The equipment will include a 150-kw, 60-cycle, General Electric generator, and three Leffel water turbines rated at 250 hp. The company has about eight miles of distributing lines, and has been granted a 10-year contract for lighting the streets of the city. The plant when completed will cost about $65,000.

LUDINGTON, MICH.—The Stearns' Lighting & Power Company has been granted a ten-year franchise in this city. The company is not to raise its present rates and is to give the city free supply of energy to operate the fire alarm system during the life of the franchise.

MAYVILLE, MICH.—Plans are being made to install another boiler in the municipal electric light and water plant. R. L. Blackmore is manager.

SHEPHERD, MICH.—The citizens of this village are considering the question of establishing a municipal electric light plant. The Village Council has decided to hold an election soon to vote on the proposition of issuing bonds for that purpose. Roy D. Matthews is village attorney.

REED CITY, MICH.—The Osceola Light & Power Company is planning to install auxiliary steam power plant, new turbines and construct a new cement dam. H. L. Millspaugh is secretary and manager.

SPARTA, MICH.—The citizens are considering a proposition to issue $20,000 in bonds for the construction of a municipal electric light plant.

AITKIN, MINN.—The Aitkin Telephone Company is making arrangements to reconstruct its plant in this city.

DETROIT, MINN.—Plans are being considered for building a new municipal electric light plant next year. George Learman is superintendent.

HINCKLEY, MINN.—It is reported that the Kettle River Quarries Company contemplates extending its transmission line to Hinckley to furnish electricity for lamps and motors in this town.

LAKE CITY, MINN.—Arrangements are being made to install another 300-hp engine in the municipal electric light plant. E. V. Lombard is superintendent.

LAKE CITY, MINN.—The Dwelle Telephone Company contemplates extending its telephone system to Oak Center.

COLUMBUS, MISS.—The Columbus Railway, Light & Power Company is installing a 350-hp Sterling water-tube boiler in its plant. S. W. Greenland is general manager.

BUTLER, MO.—The managers of the municipal electric light and power plant are considering the question of furnishing electricity for operating the pumping station of the Butler Water Company. If the contract is secured they will establish a day service. H. M. Cannon is superintendent.

CALIFORNIA, MO.—L. H. Ades, lessee of the plant of the California Electric Light & Power Company, writes that the electric plant will be rebuilt or sold to the city. The plant if purchased by the city will be rebuilt in connection with the proposed water works system.

CLAYTON, MO.—The Missouri Electric Railway Company, recently organized to take over the property of the St. Louis, St. Charles & Western Railway Company, has filed a mortgage at Clayton, to secure bonds to the amount of $1,000,000, with the Mercantile Trust Company, of St. Louis, Mo., as trustee for the bondholders. The deed sets aside $700,000 for refunding present indebtedness and for extending and repairing the system. Robert McCulloch, vice-president and general manager of the United Railways Company, of St. Louis, is president of the company.

SLATER, MO.—The municipal electric light plant has discarded the flat rate system and adopted the meter system. The rate charged for electricity is 12 cents per kw-hour. I. E. Sheperd is superintendent.

HELENA, MONT.—The Stone & Webster Company, Boston, Mass.,

has been awarded contracts for the construction of the Wolf Creek dam and for rebuilding the Hauser Lake dam, which was recently destroyed.

TOWNSEND, MONT.—The citizens are contemplating increasing the output of the municipal electric light plant, and will install a 75-kw, single-phase alternator. Henry M. Ogden is manager.

CHADRON, NEB.—Extensive improvements have been made to the plant of the Chadron Electric Light & Power Company, including the erection of new transmission lines and installation of a new generator. J. A. Ward is manager.

GENOA, NEB.—The contract for the construction of the proposed municipal electric light plant has been awarded to John W. Early, of Columbus, Neb. The plant will be operated by steam, and the cost is estimated at $11,000.

ELY, NEV.—The Ely Light & Power Company contemplates rebuilding its main transmission line through Ely to Lane City. James E. Johnson is manager.

MILFORD, N. H.—The Milford Light & Power Company is making extensive improvements and extensions to its plant, which will involve an expenditure of $20,000. Contracts for machinery have already been placed. A. A. Murray is superintendent.

ARCADE, N. Y.—The Village Trustees are considering the question of establishing a municipal electric light plant, plans for which are being prepared by H. B. Sweet, of Utica, N. Y.

BATH, N. Y.—The Public Service Commission has granted the petition of the Citizens' Electric Service Company, of Bath, for permission to construct an electric light plant to furnish electric service in Bath and the surrounding country.

BROOKLYN, N. Y.—Frederick Loeser & Company is purchasing machinery for a power house and storage warehouse, which includes power equipment with a rating of 300 kw, pumps, elevators, etc., for the storage warehouse.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company has awarded contracts for the equipment of its power house, now under construction at the corner of Smith and Ninth Streets, including two 2000-kw Curtis turbine engines, three 600-hp Babcock & Wilcox boilers and an Alberger condenser. All of the electrical equipment will be furnished by the General Electric Company, of Schenectady, N. Y. Ford, Bacon & Davis, New York City, are the consulting engineers.

DUNKIRK, N. Y.—Bids will be received by the Water Commissioners for a 500-kw turbo-generator to be installed at the municipal pumping station, also meters, transformers and arc lamps.

ELMIRA, N. Y.—The Elmira Power Company is planning to install an additional 3000-hp unit.

GENEVA, N. Y.—As no bids were submitted for lighting the city from Jan. 1, 1909, to Jan. 1, 1914, the City Council has voted to appoint a committee to secure estimates for the construction of a municipal light plant. The Geneva-Seneca Company submitted a proposition proposing that the Public Service Commission of the Second District be asked to set the prices for the different lamps, and that the company would agree to abide by the ruling of the commission and would pay all the expenses of the same. The Economic Power & Construction Company did not submit a bid, but asked the Council to make a one-year contract, instead of five years, so that they would be in a position to bid on the contract next year. The reason given by the latter company was that the litigation into which they had been forced by the Geneva-Seneca Company made it inadvisable to submit a bid at the present time.

NEW YORK, N. Y.—The United Electric Light & Power Company has closed a contract with the Astor Estate covering the complete supply of electrical energy to the new office building to be erected on Seventh Avenue block extending from 43d to 44th Streets, opposite the New York Theatre. Thirty-four stores will be included in this building. Alternating-current will operate elevators and pumps.

NIAGARA FALLS, N. Y.—The Ontario Power Company has been granted a franchise to build a transmission line across the Reservation lands of the quarries, which have been leased to the Lackawanna Steel Company.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to increase its storage battery equipment, erect new transmission lines and increase its water power. R. M. Searle is general manager.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is planning to install oil burning apparatus in its steam plant located on the river flats. Crude oil will be used and a storage tank of 1,000,000 gal. will be constructed. R. M. Searle is general manager.

SYRACUSE, N. Y.—The Onondaga County Commissioners are contemplating the construction of a power house to furnish electricity for lamps, motors and heating to the new buildings of the Onondaga County Home, now under construction, for which plans are now being prepared and bids will be called for about Sept. 1. The plans call for three horizontal tubular boilers rated at 150 hp each, equipped with coal-handling machinery, etc.; three 75-kw generators direct connected to automatic high-speed engines. The cost of the buildings now being erected is $300,000.

THERESA, N. Y.—Arrangements are being made by the Theresa Woolen Company for the construction of a 700-hp hydro-electric plant.

WALDEN, N. Y.—The hydro-electric plant of the Wallkill River Company, being constructed on the Walkill River at Walden, is expected to be completed this fall. The plant will have an output of 1720 hp and will furnish electrical energy to operate the electric railway operating between Walden and Newburgh, the Wallkill Valley Light & Power Company, New York Knife Company and other local manufacturing plants. The equipment which has been purchased will include one 800-hp Risdon-Alcott turbine water wheel, direct connected to a 525-kw, Westinghouse generator; two 460-hp wheels each direct connected to 300-kw generators, and two 50-hp wheels for direct connection to exciter units.

GREENSBURG, N. C.—The Southern Power Company has secured right of way to the city limits and will apply for a franchise to run its transmission lines into the city within a few weeks. The company is reported to be negotiating on a contract to supply the city with electricity for lamps and motors for municipal purposes.

LAKEVIEW, N. C.—An electric plant and other improvements are being installed at Lakeview, where it is proposed to develop a resort place in the near future. P. L. Gardner is interested in the undertaking.

RALEIGH, N. C.—H. H. Carr has been made general manager at Raleigh of the Carolina Power Company which was recently chartered. The company is capitalized at $3,750,000, and will distribute electricity generated at the plant at Buckhorn Falls, 28 miles distant. The company will also take over the Raleigh Street Railway, it is said, including the city lighting plant.

ROCKY MOUNT, N. C.—Plans are being prepared by F. D. Milstead, of Atlanta, Ga., for the construction of an entire new plant to replace the present municipal electric light plant. A. S. Lyon is manager.

TARBORO, N. C.—The city has decided to duplicate the machinery in the municipal electric light plant. J. A. Weddell, manager, has been instructed to purchase the machinery.

WEAVERVILLE, N. C.—The contract for the construction of the proposed electric railway of the Weaverville Electric Company from New Bridge Station to Weaverville, a distance of four miles, has been awarded to the Asheville Fuel & Dray Company, of Asheville.

WILSON, N. C.—Plans are being made for rebuilding the municipal electric light plant and greatly improving the system. The equipment of the plant will consist of one 450-hp Corliss engine direct connected to a 300-kw, 2300-volt, three-phase, 60-cycle, revolving field generator; one 150-kw, 2300-volt, three-phase, 60-cycle alternator, belted; one 60-hp, three-phase motor to drive the arc machine; one 20-kw exciter, direct connected to the motor, and one 20-kw, belted exciter, new switchboard, etc. C. E. B. Egerton is manager.

CANDO, N. D.—Arrangements are being made by the Cando Electric Light & Telephone Company to erect a new telephone line, 10 miles in length.

ASHTABULA, OHIO.—The Board of Public Service has appropriated $28,000 to purchase additional machinery for the municipal electric light plant.

BUTLER, OHIO.—The installation of an arc lamp regulator and transformer in the municipal electric light plant is being considered. William Andrews is chief engineer and electrician.

CANTON, OHIO.—The Canton Electric Company has been awarded the contract for furnishing the city with 193 additional arc lamps of 2000 cp at the rate of $41.50 per lamp per year. The contract is for a term of 10 years and the lamps are to burn 2500 hours per year. The company already has a contract for 462 lamps and the additional lamps are to replace gas lamps.

COLUMBUS, OHIO.—Bids will be received by the Board of Public Service until Aug. 24 for two side feed inclined grates, automatic stokers with dutch oven type of furnaces, for two 300-hp Babcock & Wilcox water tube boilers. The stokers to be provided with all the necessary mechanism for supplying fuel and actuating grate bars and ash and clinker crushers, also an engine of ample size to drive the stokers, the stokers to be capable of burning sufficient bituminous, nut, pea and slack coal to develop the rated horse-power of boiler and super heat the steam 100 deg. F. when draft shows ¼ in. of water. E. W. Hirsch is secretary of board.

CUYAHOGA FALLS, OHIO.—Contracts have been awarded by the Board of Public Affairs for rebuilding the municipal electric light plant. The contract for the generator, exciter and switchboard was awarded to the Crocker-Wheeler Company, Ampere, N. J., and for the new engine to the Shepard Engine Company, of Williamsport, Pa.

GREENVILLE, OHIO.—Bids will be received by James Knox Taylor, supervising architect, Washington, D. C., for construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. post office building at Greenville.

KENTON, OHIO.—The Kenton Telephone Company has increased its capital stock from $100,000 to $150,000, the proceeds to be used for the installation of a new system in Kenton.

WOOSTER, OHIO.—The Board of Public Service has engaged C. E. F. Ahlm, Cleveland, as consulting engineer in connection with the proposed municipal electric light plant.

ZANESVILLE, OHIO.—H. H. Sturtevant, proprietor of a large department store in Zanesville, has recently placed a contract with the Ohio Electric Railway Company for a complete installation of Nernst lamps to replace electric arc lamps. This is the first order for Nernst lamps to be placed in the Cincinnati territory of the Nernst Lamp Company. N. C. Draper, the new manager of the Zanesville division of the Ohio

Electric Railway Company, intends to make Zanesville a modern electric city.

EL RENO, OKLA.—Plans are being made by the Chicago, Rock Island & Pacific Railway Company for installing a 150-kw electric plant in the power house at the El Reno yards. W. E. Ballantine, of Chicago, Ill., is chief electrician.

STILLWATER, OKLA.—The City Council has granted the Stillwater Public Service Company a franchise for the installation of an electric light plant and water works system. The contract for the construction of both plants have been awarded to Burns & Company, 705 Isabella Building, Chicago, Ill., who will have entire charge of the work and purchase of all materials and let sub-contracts. Electrically operated pumping machinery will be wanted in particular.

TAHLEQUAH, OKLA.—The Tahlequah Light & Power Company has recently installed a 75-kw generator in its plant and has been furnishing a day service since July 1, 1908. R. E. Cook is secretary and manager.

WAYNOKA, OKLA.—The Waynoka Electric Light & Power Company contemplates installing an electric light plant at a cost of about $3000. M. M. Wright is engineer in charge.

WOODWARD, OKLA.—The Woodward Cotton Company will install a new 150-kw Curtis steam turbine in its electric plant. John Raynor is president and manager.

CLATSKANIE, ORE.—Arrangements are being made to organize the Clatskanie & Nehalem Valley Electric Railway Company to build an electric railway from Clatskanie to Jewell, a distance of 33 miles. D. R. Nelson, of Portland, Ore., is interested in the project.

DEADWOOD, ORE.—The Deadwood & Blachly Telephone Company has been granted a franchise to erect and operate a telephone system between Deadwood and Blachly.

HOOD RIVER, ORE.—The Hood River Electric Light, Power & Water Company contemplates changing the voltage on part of its lines from 2200 to 6600 volts and the purchase of about 40 small transformers. W. H. Chipping is superintendent.

JOSEPH, ORE.—The Joseph Electric Light & Power Company contemplates installing a new turbine and generator in its plant this year. It is proposed to change the location of the plant and increase the output. W. D. McCully is manager.

McMINNVILLE, ORE.—The city is advertising for bids for the construction of a power plant for the municipal electric light system, to be located on Baker Creek, six and one-half miles from the city. The equipment of the plant to include one 400-hp water wheel, one 200-kw, three-phase, 6600-volt alternating-current generator. An engine will be installed later. A. E. Vanosse is superintendent.

MILTON, ORE.—The citizens are considering the question of increasing the output of the municipal electric light plant to 300 or 400 kw. W. R. Craig is superintendent.

PRINEVILLE, ORE.—The construction of a long-distance transmission line is now under consideration by the Prineville Light & Water Company. C. L. Shattuck is superintendent.

TOLEDO, ORE.—W. W. Vaughn, president of the Vaughn Construction Company, of Detroit, Mich., is making investigations pertaining to the construction and operation of a power plant at the Agency, electricity to be transmitted to Toledo and Newport.

FREEDOM, PA.—The Borough Council is considering the question of establishing a municipal electric light plant and has appointed a committee to secure information pertaining to the subject.

HAMBURG, PA.—Extensive improvements have been made to the plant of the Hamburg Electric Company, including the installation of a 220-volt, three-wire system and the erection of additional transmission lines. A day service will be established in August. The company will also substitute enclosed arc lamps for the open arcs, and is in the market for a boiler of 125 hp, engine and a 50-light arc machine. Frank Curtis is superintendent.

HUNTINGDON, PA.—The Town Council has granted a franchise to the Juniata Valley Electric Railway Company for an extension through West Huntingdon to the borough line in order to reach Cold Spring Park, three miles beyond.

INDIANA, PA.—Plans are being made by the Indiana Provision Company to extend its transmission lines to the County Home, a distance of one and one-fourth miles. G. P. McCartney is manager.

OLYPHANT, PA.—It is proposed to increase the output of the municipal electric plant by the installation of an addition of a 200-kw unit.

WEATHERLY, PA.—Plans are being considered to install two 150-hp tubular boilers in the municipal electric light plant. H. Chamberlain is superintendent.

WEST CHESTER, PA.—The contract for the construction of the proposed electric railway between West Chester and Pottstown was awarded to Charles F. Goldstrom, of Pittsburg, Pa.

BISHOPVILLE, S. C.—The Bishopville Telephone Company, recently organized, has taken over the old plant in the city, which it will reconstruct at a cost of about $10,000. Thomas G. McLeod is president.

CHESTER, S. C.—The Southern Power Company, of Charlotte, has closed a contract with the town of Chester to take over the old electric light plant and to supply the town with electricity for lamps. Electrical energy will be brought from Great Falls, from which a transmission line will be built, which will form part of a transmission line to be run to Spartanburg, S. C., later.

BERESFORD, S. D.—Louis Wagner, owner of the local electric light plant, contemplates substituting 60-watt tungsten lamps for the lamps now in use.

SCOTLAND, S. D.—It is reported that an electric lighting system will be established in the town.

STURGIS, S. D.—The Sturgis Power & Light Cimpany has completed the rebuilding of its lines and is now installing an additional 100-hp Twin City engine and a 75-kw Bullock generator in its plant. A day service will be established. U. S. Allison is manager.

HUMBOLDT, TENN.—The Board of Public Works has awarded contracts for equipment for the municipal electric light plant as follows: To the Chuse Engine & Manufacturing Company, Mattoon, Ill., for one 250-hp engine; also a 150-kw, 60-cycle, three-phase, 2200-volt engine type generator. W. A. Moore is superintendent.

NEWPORT, TENN.—The Unaka Tanning Company is planning to install an electric plant to furnish electricity to operate its tannery and the machinery of the Chilhowee Extract Company. The water power of Pigeon River will be developed to furnish power to generate electricity.

MEMPHIS, TENN.—Contracts have been awarded by the Lake View Traction Company for the first section of the interurban railway between Memphis and Lake View, about 12 miles in length, to M. J. Roach.

RIPLEY, TENN.—The Ripley Light, Water & Ice Company is making arrangements to move its plant and change its system to 60 cycles and to discard the direct-current service. W. A. McCallum is superintendent.

WINCHESTER, TENN.—A day service in connection with the municipal electric light plant will be established. W. J. Miller is manager.

GALVESTON, TEX.—The Brush Electric Light & Power Company contemplates erecting about five miles of power circuits. Fred M. Lege, Jr., is manager.

KILLEEN, TEX.—The City Light & Water Company contemplates installing an additional engine. W. R. Burks is secretary and manager.

SEGUIN, TEX.—The Seguin Electric Light & Power Company is preparing plans for the rebuilding of its water power plant and expects to reconstruct its transmission lines within the next six months. L. A. Voigt is manager.

VAN ALSTYNE, TEX.—Plans are being considered to install an alternating-current generator and engine in the local electric light plant, which is owned by D. P. and O. S. Yoder.

AMERICAN FORK, UTAH.—Preliminary surveys are being made for a third power plant for the Utah County Light & Power Company. The plant will be located in Alpine Canyon, between six and eight miles from American Fork. The company furnishes electricity for the large pumping plant owned by Salt Lake City at the mouth of the Jordan River, and has recently completed a transmission line, which will furnish electrical energy to operate the Knight smelter at Tintic, and will furnish electricity for the smelter at Silver City, and also all the electricity used in the northern part of Utah County.

MURRAY, UTAH.—The Progress Company is considering the question of installing new water wheels in its plant. Chester P. Cahoon is superintendent.

RICHFIELD, UTAH.—The Richfield Electric Light & Power Company contemplates installing a 120-kw generator in its steam plant and 2000-kw water power plant on the Sever River. Thomas Brown is manager.

BARTON, VT.—The Village Electric Light Department is planning to build a steel penstock about 700 ft. long and 4 ft. in diameter in connection with the municipal electric light plant. O. H. Mossman is electrical superintendent.

GROTON, VT.—Plans are being made by Clark & Davidson, owners of the grist mill, to install an electric light and power plant to furnish electricity to operate the machinery in the stone sheds and for street and residential lighting. The company has purchased the old Baldwin Mill site and will rebuild the dam to furnish power to operate the plant. The equipment of the plant will include a 75-kw Westinghouse generator and twin water wheels of 120 hp made by the S. Morgan-Smith Company, of York, Pa.

MONTPELIER, VT.—The Barre & Montpelier Traction Company has awarded a contract for the construction of a dam and power house on the Winooski River at Kinney's Mills.

BASIC CITY, VA.—The City Council is considering the question of establishing a municipal electric light plant and water works system, and contemplates developing water power, securing about 500 hp. W. H. Page is mayor.

CULPEPER, VA.—The Culpeper Light & Ice Company contemplates extending its transmission lines to the suburbs. G. F. Major is superintendent.

FREDERICKSBURG, VA.—Work will soon be resumed on the construction of a dam across the Rappahannock River by interests connected with the Fredericksburg Power Company. The dam will be 800 ft. long and 22 ft. high, and will increase the output from 2000 to 8000 hp. William C. Whitner, hydraulic engineer, of Virginia Passenger & Power Company and president of the Fredericksburg Power Company, will have charge of the work.

NEW MARKET, VA.—The New Market Electric Light & Power Company will extend its transmission line about two miles. Rice Snapp is secretary and general manager.

BREMERTON, WASH.—Bids will be received at the Bureau of Yard and Docks, Navy Department, Washington, D. C., until Sept. 5, for furnishing and installing an electric elevator at the navy yard, Bremerton, Wash. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named. R. C. Holliday is chief of bureau.

BUCKLEY, WASH.—The Buckley Electric Company is planning to develop a water power in the near future. W. A. Shumaker is president.

CENTRALIA, WASH.—C. A. Harmony, city electrician, writes that plans are being made to furnish the city with electricity for commercial and residential lighting from the municipal electric light plant.

NEWPORT, WASH.—The Northern Electric Company is planning to make extensions to its transmission lines and general repairs to its overhead system. J. W. Beckwith is superintendent.

NORTH YAKIMA, WASH.—The Northwest Light & Power Company contemplates extending its transmission lines to several adjacent towns. G. C. Arrowsmith is superintendent.

PORT TOWNSEND, WASH.—Plans are being made by the Independent Telephone Company to extend its telephone lines to Morganshill, Happy Valley and other portions of the city.

PUYALLUP, WASH.—The Tacoma Industrial Company contemplates the construction of a new substation and offices. D. C. Washburn is agent.

SEATTLE, WASH.—The contracts for erecting a system of cluster lamps on First Avenue have been awarded as follows: Subdivision No. 1 to Strehlaw, Freeze & Peterson, of Seattle, for constructing system, including excavations, furnishing and installing manholes, conduits, etc., for $30,454; subdivision No. 2 to Agutter-Griswold & Company, of Seattle, for furnishing transformers, cables, pole furnishings, etc., for $12,586, and subdivision No. 3 to the Olympia Foundry Company, Seattle, for cast-iron poles, for $5,625.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company will install a 500-kw frequency changer. C. C. Curley is manager.

WENATCHEE, WASH.—The Wenatchee Electric Company contemplates making extensive extensions to its distributing system. Charles F. Keiser is superintendent.

WELCH, W. VA.—The Welch Water, Light & Power Company contemplates extending its transmission lines to Hemphill, W. Va. D. J. Howell is treasurer and manager.

CUMBERLAND, WIS.—The citizens have voted to rebuild the municipal electric light plant, and a committee has been appointed to investigate the matter. A. F. Wright is city clerk.

GILLETT, WIS.—T. A. Pamperin, of Oconto, Wis., has submitted a proposition to the Village Council for the installation of an electric light plant in Gillett.

KEWAUNEE, WIS.—Bids will be received by W. Wiesner, city clerk, until Aug. 27, for the construction of an electric light plant, the work to include the construction of a brick building, pole line and wiring; one 50-kw, two-phase, alternating-current dynamo, arc light equipment, and an 85-hp high speed compound condensing steam plant. Plans and specifications can be seen at the office of the city clerk at Kewaunee, and at the office of Oscar Claussen, St. Paul, Minn., consulting engineer.

PESHTIGO, WIS.—The Northern Hydro-Electric Power Company, of Green Bay, Wis., is advertising for bids for the construction of an 8000-hp hydro-electric plant on Peshtigo River, which include the construction of a dam and power house. The cost of the work is estimated at $500,000. D. Mead, of Madison, Wis., is preparing plans for the plant. S. H. Josslyn, of Oshkosh, Wis., is president of the company.

BUFFALO, WYO.—Arrangements are being made by the Buffalo Manufacturing Company to extend its transmission lines to the State Soldiers' and Sailors' Home, a distance of three miles. O. A. Leggett is manager.

LANDER, WYO.—Arrangements are being made to extend the Kemmerer-Pinedale Telephone line to Lander.

LETHBRIDGE, ALB., CAN.—The City Council has decided to submit a by-law to the rate payers for the purchase of the electric plant of the Lethbridge Electric Company, for $74,000. The extension and removal of the plant will cost $100,000.

NELSON, B. C., CAN.—The Kootenay Development Syndicate has been granted a license to develop and distribute electrical energy. The office of the company is in this city.

NELSON, B. C., CAN.—The city has taken over the municipal electric power plant at Bonnington, nine miles west of Nelson, on the Kootenay River. The plant has an output of 1500 hp and furnishes electricity for operating the light and power plant and electric railways and local industries. Owing to the increased demand for electrical energy a second unit has become necessary, and a by-law will be submitted to the people next month in regard to increasing the output of the plant.

YARMOUTH, N. S., CAN.—A new engine and 300-kw generator will be purchased for the Yarmouth street railway system by the City Council.

HAMILTON, ONT., CAN.—Mayor Stewart has refused to sign the contract with the Cataract Power Company, which was authorized by the Board of Aldermen in July, giving as his reason that the rate payers have voted for a contract with the Hydro-Electric Power Commission, and that he believes that it is for the interest of the city to make a contract with the Commission rather than with a private company.

KINGSTON, ONT., CAN.—Arrangements are being made to submit a by-law to the rate payers to determine whether the city shall buy out the Kingston, Portsmouth & Cataraqui Street Railway and run it as a municipal enterprise. The city has been supplying the company with power at 1.66 cents per kw-hour, but it has been discovered it costs the city 1.94 cents per kw-hour at the switchboard.

PORT ARTHUR, ONT., CAN.—Plans are being considered to construct transmission lines to Kakabeka Falls, a distance of 24 miles, and build a belt line railway, and also double tracking its railway system in the near future. W. P. Cooke is chairman of the electric railway, light and telephone commission.

ST. THOMAS, ONT., CAN.—The city engineer has presented to the City Council an estimate of the cost for extending the municipal street railway system to Port Stanley, a distance of seven miles. The cost will be $51,200 exclusive of equipment, to which must be added $11,690 for overhead work.

TILBURY, ONT., CAN.—An independent telephone company will be organized in this city with a capital stock of $40,000. For further information address Dr. Kneister, Comber, Ont.

TORONTO, ONT., CAN.—Application will be made by the Toronto Suburban Railway for a 25-year extension of its franchise and for the right to extend its line through Swansea to the Lake Shore Railroad.

TORONTO, ONT., CAN.—The Toronto Power Company has been granted permission to increase its capital stock from $100,000 to $1,000,000.

TRENTON, ONT., CAN.—The Trenton Electric & Water Company is planning a large water power development. J. J. Wright, of Toronto, is manager.

WELLAND, ONT., CAN.—Plans are being considered for the construction of an electric railway from Dunville across the Niagara Peninsula. James A. Ross, of Wellandport; George Dunstan, of Toronto, and P. T. McGrath, of Worcester, Mass., are interested in the enterprise.

WINDSOR, ONT., CAN.—Arrangements are now being completed here to organize a company to build an electric railway to Detroit, Mich., by way of the Michigan Central Railway tunnel. J. A. Smith, Dr. Revell, A. J. Nelles, G. L. Leggatt, W. Bong, of Windsor, Ont.; G. Bouteiller, of Walkerville, Ont., and G. King, of Detroit, Mich., are interested.

MOOSE JAW, SASK., CAN.—Arrangements are being made to increase the equipment of the municipal electric light plant, including the installation of a 500-kw steam turbine, 500-hp Babcock & Wilcox boilers, stokers and condensers. E. K. Reading is superintendent.

GUANAJUATO, MEX.—The Guanajuato Power & Electric Company has recently installed four new transformers of 1000 hp each, increasing the output of the plant to 8000 hp. Plans are being considered to increase the output to 12,000 hp in the near future. Norman Rowe is general manager.

New Incorporations.

SAN JOSE, CAL.—Articles of incorporation have been filed for the Bakersfield & Ventura Railway Company by Charles T. Carnahan, John A. Ewing, Marton M. Hamma, Samuel M. Thompson, Jr., and H. Ferguson, all of Colorado. The company is capitalized at $500,000 and proposes to purchase and complete the railway formerly owned by the Bakersfield & Ventura Railway Company, which was sold by the Title Insurance & Trust Company, of Los Angeles, to E. W. Phelps as special administrator.

WILMINGTON, DEL.—The Electrical Corporations Consolidated has been incorporated, with a capital stock of $1,500,000, by F. M. Shive, S. E. Roberson, Harry W. Davis, all of Wilmington.

WILMINGTON, DEL.—The Central Texas Traction Company has been incorporated, with a capital stock of $300,000, by J. J. Sears, of Aledo, Tex.; J. C. Howard, of Houston, Tex.; W. W. Clopton and J. V. Watkins, of Corsicana, Tex.

MARION, IND.—The Marion & Logansport Traction Company has filed articles of incorporation with a capital stock of $40,000 for the purpose of building an electric street and interurban railway in the counties of Grant, Miami and Cass. The directors of the company are: John O. Spurgeon, Mead S. Hays, John C. Wilson, Alva Williamson, Lewis S. Marks, Victor S. Wise and John Minnick.

MITCHELLVILLE, IA.—The Rural & Four City Telephone Company has been chartered with a capital stock of $50,000, by H. C. Korf, J. H. Little, B. F. Gilbert, A. D. Miller and L. M. Grimes.

LONG GROVE, IA.—The Long Grove Telephone Company has been incorporated with a capital stock of $10,000 and the following officers: R. K. Brownlie, president; Leonard Lischer, vice-president; George B. Maxwell, secretary and treasurer.

BARAGA, MICH.—The Baraga County Telephone Company has been formed by Martin Voetsch, of Baraga, and A. W. Stark, of L'Anse.

The company has taken over the local exchanges at Baraga and L'Anse, and is planning to erect a number of new telephone lines, including toll lines to Skanee and Huron Bay.

LUDINGTON, MICH.—The United Telephone Company, of Michigan, has been organized at Ludington. The company is capitalized at $200,000 and is to take over the property and holdings of the Lake Shore Telephone Company, now operating in Mason and Oceana Counties, and expects to move its general offices from Hart to Ludington, where a new exchange building is to be erected. The company contemplates making extensive improvements and extensions to the system, which will involve an expenditure of about $78,000. The officers of the company are: W. A. Cartier, of Ludington, president; Gardner Sands, of Pentwater, vice-president; Thomas Bromley, Jr., of Hart, is secretary, treasurer and general manager.

NEWFOLDEN, MINN.—The Newfolden Central Telephone Company has been organized for the purpose of constructing a telephone line between Ellerth and Newfolden. The officers of the company are: Ole Hjelle, of West Valley, president; A. S. Rokke, secretary, and H. E. Myhre, treasurer.

ROYALTON, MINN.—Articles of incorporation have been filed for the Royalton Power & Light Company with a capital stock of $10,000 to build an electric light plant on the Platte River. Charles R. Rhoda is secretary.

DICKENS, NEB.—The North Platte & Dickens Telephone Company has been incorporated, with a capital stock of $5,000.

CARSON, NEV.—The Hercules Electric Company has been incorporated with a capital stock of $25,000, by J. A. Kurtz, W. E. Kurtz and others.

NEWARK, N. J.—The Arcade Block Lighting Company has been incorporated, with a capital stock of $40,000, by James O. Sharp, H. A. Phillips and F. J. Greenberg.

BREVARD, N. C.—The Cascade Company, with capital stock of $30,000, has been formed to develop a water power on Little River near Revard. The company proposes to generate and transmit electricity in Brevard and surrounding territory. W. P. Whitmire, of Brevard, is interested in the enterprise.

CHARLOTTE, N. C.—The Charlotte Power Company has been incorporated with a capital stock of $300,000 to build electric light and power plants. The incorporators are: W. S. Lee, W. H. Martin, L. C. Harrison and R. B. Harrington, all of which are officials of the Southern Power Company of Charlotte.

FAYETTEVILLE, N. C.—The Little River Power & Transportation Company has been incorporated, with a capital stock of $100,000, by W. D. McNeill, J. F. Gilmore and Mrs. M. B. McRae.

CANAL WINCHESTER, OHIO.—The Farmers' Independent Telephone Company has been chartered with a capital stock of $25,000, by McG. Martens, Thomas J. Barr, Thurman T. Courtright, W. F. O'Gara and B. C. M. Hastings. The company proposes to erect a telephone system connecting Canal Winchester, Columbus and Lancaster.

COLUMBUS, OHIO.—The Columbus Light, Heat & Power Company has been incorporated with a capital stock of $2,000,000 by Edwin R. Sharp, William K. Lanman, H. Waite, George Hardy and H. T. Stewart. The purpose of the company, it is said, is to purchase the plant and holdings of the Public Service Company and to lease them to the Columbus Railway & Light Company, which now operates all the street railway lines and lighting properties of the Columbus Edison Company. Robert Sheldon is president of the Columbus Railway & Light Company.

ST. PARIS, OHIO.—The Farmers' & Merchants' Telephone Company has been incorporated, with a capital stock of $5,000, by John E. McGowan and others.

DEPEW, OKLA.—Depew Telephone Company has incorporated with a capital stock of $6,000 by M. Pate, J. S. Crall and others.

GRACEMONT, OKLA.—The Gracemont & Coger Telephone Company has been incorporated with a capital stock of $2,000 and the following named directors: Cryde Dannold, J. S. Cline, A. Flanigan, M. O. Nation, W. H. Higgins, all of Gracemont.

HOLLIS, OKLA.—Articles of incorporation have been filed for the Hollis-McKnight Telephone Company with a capital stock of $3,500. The directors are: J. B. Moore, T. J. Stewart, M. A. Barnum, John Scott, W. C. Wynn, all of Hollis, and R. H. Holland, of Sandy.

OKLAHOMA CITY, OKLA.—The Pioneer Telephone Company has been incorporated, with a capital stock of $25,000. The directors are W. A. Lovejoy, E. P. Spears and N. S. Sherwood, all of Oklahoma.

OKLAHOMA CITY, OKLA.—The Banner Rural Telephone Company has been incorporated with a capital stock of $2000 and the following directors: L. Stichcomb, George L. Myers and J. E. McKinley, of Yukon.

PEEK, OKLA.—Articles of incorporation have been filed for the Hackberry Telephone Company, with a capital stock of $5,000, by D. M. Davis, D. E. Glaney and J. C. Pierce, of Arnett; H. M. Conner, of Peek, and S. T. Lawrence, of Reason.

QUINLAN, OKLA.—The Enterprise Telephone Company has been chartered with a capital stock of $1,600 by O. A. Dauphin, John Holloway, A. Kelso, G. A. Tefft, of Curtis; A. Washburn, J. J. Hall and P. W. Nickerson, of Quinlan.

ASHLAND, ORE.—The Granite City Light & Power Company has been incorporated with a capital stock of $100,000 by F. K. Anderson, C. H. Hosley, G. W. Barron, George W. Owen and I. N. Snook, all of Ashland.

OAK GROVE, ORE.—The Oak Grove Telephone Company has been organized with a capital stock of $4000. Judge Dimick, of Oregon City, is interested in the enterprise.

PORTLAND, ORE.—The Coos Bay Railway & Terminal Company has been incorporated with a capital stock of $250,000 to construct an electric railway around Coos Bay and down the coast south of Sunset Bay. The officers are: Henry Hewitt, Jr., president; L. J. Simpson, of North Bend, vice-president, and Seymour Bell, of Marshfield, secretary and manager.

MIDWAY, PA.—The Midway Mutual Telephone Company has been incorporated with a capital stock of $5,000.

BELLEVERNON, PA.—The Westmoreland & Fayette Telephone Company has been incorporated, with a capital stock of $1,000, to construct a telephone system connecting Bellevernon with Fayette City, Webster, Perryopolis, West Newton, Smithton and Monessen.

BELLEVILLE, PA.—The Belleville & Reedsville Railroad Company has been incorporated with a capital stock of $100,000. The officers of the company are: L. M. Yoder, of Belleville, president; S. M. Patterson, of Avondale, vice-president; F. W. Warner, of Belleville, treasurer.

HARRISBURG, PA.—Articles of incorporation have been filed for the Gilbrook Telephone & Telegraph Company with a capital stock of $5,000. The directors are: H. P. Gilbert, of New York, N. Y.; Elroy & Westbrook, Frederick Gilbert, Knoxville, Pa.; Joseph Cooper, Little Marsh, Pa.; E. M. Tucker, Westfield, Pa., and G. S. Howland, of Westfield Township, Pa.

HURON, S. D.—The Huron Street Railway Company has been chartered with a capital stock of $50,000. The incorporators are: John W. Smith, Henry M. Stevens, Harry M. Jewett, of Huron, S. D.; William K. Coler, of Brooklyn, N. Y.; Morton D. Walling, of Milwaukee, Wis.

ABERDEEN, S. D.—Articles of incorporation have been filed for the Aberdeen Street Railway Company by Charles T. McCoy, Frank H. Haggerty, H. W. Marple, Frank W. Brooks, S. H. Jumper, Lannar G. Johnson and John A. Houlahan, all of Aberdeen. The company is capitalized at $250,000, and proposes to construct a street railway system in Aberdeen and vicinity, about 20 miles in length.

CHESTNUT MOUND, TENN.—The Chestnut Mound Telephone Company has been organized to install a local system at Chestnut Mound and connection with the nearby towns and with Nashville, by the way of Gordonville. The officers of the company are: L. C. Thompson, president; A. H. King, vice-president; J. P. Elrod, secretary, and F. C. Hargis, treasurer.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Blue Bell Telephone Company, of Lawrence County. The company is capitalized at $2,400, and the incorporators are C. H. Hollins, J. M. Forsythe, E. L. Forsythe, J. Allen Litterell, W. E. Kelly, R. C. Johnson and G. W. Sweanney.

NASHVILLE, TENN.—The Nashville & Lewisburg Railway Company has been incorporated to construct a railway from Nashville to Lewisburg, a distance of about 50 miles, to be operated by steam or electricity. The incorporators are E. R. Richardson, Edgar Jones, J. R. Thompson, R. J. Lyle and J. R. Shephard, of Nashville.

ROANOKE, VA.—The Roanoke Light & Traction Company has been incorporated with a capital stock of $2,000,000, for the purpose of constructing and operating electric railway, heating, lighting and power plants in Roanoke, Lynchburg and Clifton Forge. The company contemplates the construction of about 200 miles of railway, and utilizing the water power of James River at what is known as the "Horseshoe" above Lynchburg, to generate electricity to operate the system. The officers of the company are; James P. Woods, president; R. C. Jackson, vice-president, and James G. Martin, secretary and treasurer.

STRASBURG, VA.—The Rock Springs Electric Company has been chartered, with a capital stock of $25,000, and the following-named officers: B. H. Bowser, president; H. H. Copp, vice-president, and C. M. Chiles, secretary.

BREMERTON, WASH.—The Kitsap County Telephone Company has been incorporated with a capital stock of $5,000 by Herbert B. Gehr, W. D. Calder, J. W. Potter, Smith F. Reynolds, Edwin P. Dole and others.

COLVILLE, WASH.—Articles of incorporation have been filed for the Stevens County Power & Light Company of Spokane. The company is capitalized at $100,000 and the incorporators are: E. B. Bird, Horace R. Williams and T. D. Allen.

ORIENT, WASH.—The Orient Water & Light Company has been incorporated, with a capital stock of $10,000, by O. G. Barnard, W. J. Gilpin and William J. Stiles.

OLYMPIA, WASH.—Articles of incorporation have been filed with the Secretary of State for the Noosack Valley Traction Company. The capital stock is placed at $1,250,000 and the incorporators are: W. P. Alward, J. S. Wheeler, J. E. Morrison, Edward Brown, W. H. Jarrett and J. William Welch.

OLYMPIA, WASH.—Articles of incorporation have been filed with the Secretary of State for the Rural Telephone Company, of Spofford, by E. D. Overstreet, F. L. Riffe, C. N. Jordan, John O. Doss, J. T. Chilcout and others. The capital stock of the company is placed at $10,000.

TACOMA, WASH.—Articles of incorporation have been filed for the Wilkeson Light & Water Company by I. B. Winsor, W. B. Williams and C. O. Bates. The company is capitalized at $50,000.

SLANESVILLE, W. VA.—The Slanesville Telephone Company has been incorporated, with a capital stock of $5,000, by T. D. Bloom, G. W. Spicer, H. E. Streby, of Spring Gap; T. F. Henderson, of Slanesville; A. W. Miller, of Cacapehon.

VERNON, W. VA.—The Farmers' Rural Telephone Company has been incorporated, with a capital stock of $5,000, to construct and operate a telephone system in Vernon and throughout Wetzel County. The incorporators are Jacob Schupbach, G. W. Yost, Albert Schupbach and Adolph Durig, of Vernon, and G. J. Bothesberger, of New Martinville.

WILLIAMSON, W. VA.—Articles of incorporation have been filed for the Lawson Telephone Company, which proposes to construct about 100 miles of telephone line. Harry Lawson is president of the company.

Company Election.

MONTREAL, QUE., CAN.—The following officers have been elected for the Montreal Suburban Tramway Company for the present year: Hon. J. L. Forget, president; K. W. Blackwell, vice-president; W. G. Ross, general manager. Directors, P. Galibert, Sir H. M. Allan, R. Meighen, P. Dubee.

New Industrial Companies.

THE LORAIN ENGINEERING & CONSTRUCTION COMPANY, of Lorain, Ohio, has been chartered, with a capital stock of $10,000, by F. J. Penny, Minor Corron, G. C. Penny and E. P. Carron.

THE RELIANCE ELECTRIC & MACHINE WORKS, of Astoria, Ore., has been incorporated, with a capital stock of $4,000, by J. J. Kenny, H. W. Cyrus and Claude E. Hicks. The company proposes to buy, sell and repair electrical machinery.

THE OTTO GOLDBERG COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture gas and electric fixtures and plumbing materials. The incorporators are Otto Goldburg, Louis Jampol and Herman Goldberg.

THE SCHILLINGER CONSTRUCTION COMPANY, of Gary, Ind., has been incorporated for the purpose of making a specialty of constructing steel and interurban railways and power houses. Albert C. Carver, Charles Siebold and G. A. Schillinger are directors.

THE PREMIER ELECTRIC LAMP COMPANY, of Boston, Mass., has been chartered, with a capital stock of $50,000, and the following officers: James J. Geary, of Boston, Mass., president; Frederick Allen, of Arlington Heights, treasurer, and Charles E. Estey, of Malden, clerk.

THE GENERAL WAVES POWER COMPANY, of Camden, N. J., has been incorporated, with a capital stock of $200,000, to carry on a general machinists, mechanical and electrical engineering business. The incorporators are E. E. McWhinney, G. E. Holmes and F. A. Kunz, of Camden, N. J.

THE CANADIAN WEBER GAS COMPANY, of Toronto, Ont., has been incorporated, with a capital of $300,000. It will manufacture and sell in Canada the products of the Weber Gas Engine Company, of Kansas City, Mo. The directors are Robert G. Weber, of Kansas City, Mo.; R. J. Gaudy, H. McDonald, J. A. Gaudy and H. Kiteley, of Toronto.

Legal.

ELECTRIC LIGHT AND WATER PLANTS IN RECEIVER'S HANDS.—James T. Anderson, of Marietta, Ga., has been appointed receiver of the Georgia Manufacturing & Public Service Corporation. The company was chartered at $500,000, and supplied the city of Marietta with electricity for lamps and motors and also owned the water works system. Creditors in Atlanta filed the petition for placing the concern in bankruptcy.

INJURIES RESULTING FROM BEING STRUCK BY CHIMNEY BRICKS LOOSENED BY AN ELECTRIC WIRE.—A telephone company's wire was attached to the chimney, thence extending across the street. During the operations carried on in the construction of a building on the opposite side of the street, the boom of a derrick swung against the wire with sufficient force to pull over the chimney, thus causing the injury sued for. The wire had been in position for two years with the consent of the municipal authorities. There was evidence that the chimney had been weakened by age and decay, and the negligence of the defendant in maintaining its wire upon it was relied on as constituting the efficient and proximate cause of the accident. Said the court: "Was the specific act of negligence charged against the defendant in this case the natural, efficient, and, hence, a proximate cause of the accident; or was it the result of the intervention of an independent cause, which defendant was not bound to anticipate, and without which the injury would not have happened? I think that the latter was the case. *The negligent conduct of the persons in using the derrick upon the building was an unusual occurrence and not such as should have been foreseen by the defendant.*" The company was accordingly not held liable. Leeds v. N. Y. Telephone Co., 178 N. Y. 118, 70 N. E. Rep. 219.

In another case the plaintiff in an action against a telegraph company alleged that the defendant company had loosely and carelessly attached its wire to an ornamental projection on the corner of the roof of a building by nailing a piece of wood to the cornice with two nails and fastening the wire to the piece of wood. This, it was claimed, so loosened the brick that a slight pull on the wire would cause them to fall to the street. A fire broke out in the same block and persons gathered on the roof of the building to which the wire was attached to witness the conflagration. One of the bricks where the wire was affixed fell down and struck the plaintiff, who happened to be in the street. It was held that an instruction, given by the court to the jury, which made the dangerous character of the wires and their fastenings the sole test of defendant's liability, and required the jury to find for the plaintiff without regard to the diligence in fastening the wires and maintaining the appliance in safe condition was erroneous. A judgment which was rendered in favor of the plaintiff on the trial was accordingly reversed on appeal. Southwestern Telegraph & Telephone Co. v. Beatty, 63 Ark. 65, 37 S. W. 570.

Personal.

MR. HENRY M. ZAUNER has been appointed chief engineer of the municipal electric light plant at Fort Wayne, Ind.

DR. N. M. HOPKINS, the well-known electrical engineer, who has lately taken up fiction with great success, will have in the September *Lippincott* another complete story, based on scientific facts, and worked out along detective lines.

MR. ARTHUR H. KIMBALL, superintendent of the electrical department of the Fitchburg Gas & Electric Company, of Fitchburg, Mass., has resigned his position to become general manager of the Fall River Electric Light Company, of Fall River, Mass.

MR. F. C. LORING, electrical engineer, of Ithaca, N. Y., has been retained by the City Council of Marion, Ind., to enlarge and rebuild the municipal electric light plant, plans for which have been under consideration. Mr. Otis Weesner is the superintendent.

MR. CLIFFORD HAYES, superintendent of motive power and machinery at the plant of the Ludlow Manufacturing Company, at Ludlow, Mass., has been appointed superintendent of the Fitchburg Gas & Electric Light Company, of Fitchburg, Mass., to succeed Mr. Arthur H. Kimball, resigned.

MR. WM. C. HALSTEAD, electrical engineer of the H. B. Rust Company, Providence, R. I., has returned from Florida, where he has finished the installation of two large oil-engine, electrical generating plants —one at Mulberry, consisting of 14 22-hp Diesel engine units, and the other at Purce, consisting of six similar units.

MR. E. O. MUNSON, formerly of the Rochester sales department of the Stromberg-Carlson Telephone Manufacturing Company, has been appointed assistant advertising manager of that company, with whom he has now been connected for over five years. During that time his work has included a year in the switchboard assembling department. The other four years have been spent by him as territorial traveling salesman and correspondence salesman, thus acquiring a wide acquaintance in the field.

MR. SAMUEL RING, of the New York Edison Company, has resigned his position to join the staff of W. S. Barstow & Co., of New York and Portland, Ore. Mr. Ring went with the New York Edison Company in 1896 as private secretary to the associate general manager, Mr. J. W. Lieb. He was later placed in charge of the map and record bureau, and lately has been assistant general foreman of the distribution department. Mr. Ring left for Portland on Aug. 4, and will report to Mr. W. S. Turner, the manager of the Northwestern office of the Barstow company there.

MR. WILLIAM C. ANDREWS has taken a position at the General Electric Company's main lamp sales office, Harrison, N. J., entering into the work at a time when the growth of the tungsten and tantalum lamp sales is making this industry one of the most active on the electrical list. Mr. Andrews was formerly sales department engineer of the Stanley Instrument Company, Great Barrington, Mass., in charge of the sales and order departments, and has recently been connected with the General Electric Company at Schenectady, N. Y. While at Schenectady he was secretary of the local section of the American Institute of Electrical Engineers, and active in the successful development of the so-called "Schenectady plan" of organization.

MR. ARTHUR WILLIAMS.—Confirming rumors that have been current lately in well informed circles, the St. Louis newspapers announce that Mr. Arthur Williams, chief inspector of the New York Edison Company, has accepted an offer to become president and general manager of the Union Electric Light & Power Company of that city to succeed Mr. W. V. N. Powelson. As contract manager for the New York system Mr. Williams has made a great success of his work, and his connection with Mr. John I. Beggs, who is so prominent in Union affairs, goes back a score of years to the time when Mr. Beggs was in charge of the New York system, and noted Mr. Williams' ability. The transfer to St. Louis will be made this fall. Mr. Powelson will, it is understood, become a member of the hydro-electric engineering firm of Cooper & Powelson, and will take up first some large power developments on the Mississippi River.

Trade Publications.

CRANES AND HOISTS.—The Northern Engineering Works, Detroit, Mich., have issued a booklet on "Northern" cranes. It is of pocket or pigeon-hole size and illustrates in condensed form many of their designs of electric traveling cranes, hand-power cranes, electric hoists, etc., made by this concern.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is now distributing information on its meter testing load box for use in testing integrating wattmeters, either in the laboratory or at the point of installation. The boxes are of novel design, in that the various resistance units are mounted in enclosed fuse clips and are handled in very much the same manner as the Standard Code Fuses.

ELECTRIC BLOWERS FOR FURNACES.—Bulletin No. 3306, of the Emerson Electric Mfg. Company, St. Louis, has for its subject the application of the electric motor to furnace draft. This application furnishes an admirable solution to the hot-air heating problem, and is well treated in detail. Illustrations show the simple manner in which the motor can be installed for this use.

FORT WAYNE BULLETINS.—Bulletins Nos. 1107 and 1108 of the Fort Wayne Electric Company have for their respective subjects standard alternating-current, single-phase switchboard panels and multiphase revolving-field, belted generators. The first-mentioned includes also illustrated descriptions of Fort Wayne switchboard instruments. Excellent illustrations on a large scale show the constructional details of the revolving-field generator.

SILICO-VANADIUM STEEL TRANSFORMER CORES.—The Central Electric Company, Chicago, is distributing data sheets on the Pittsburgh high-efficiency transformers, which employ the recently developed silico-vanadium electrical steel. This steel is claimed to be one of the most important recent developments in transformer design. The company is also distributing its new contract forms, giving complete prices and guarantees on the Pittsburgh transformers.

MERCURY RECTIFIERS FOR PICTURE MACHINES.—The General Electric Company, Schenectady, N. Y., has just issued an attractive folder in which it describes its mercury arc rectifier in connection with moving picture machines. The rectifier enables the operator to obtain direct current from an alternating current circuit, thus securing the best light for the purpose at low cost. This outfit forms a simple and compact piece of apparatus, requiring practically no more attention or adjustment than the ordinary rheostat, and will operate satisfactorily on any alternating-current voltage from 200 to 240, and any frequency from 40 to 140 cycles. A full description and prices are contained in Folder No. 3681.

SUBWAY TRANSFORMERS.—The demand for transformers suitable for underground installation is a constantly increasing one. The General Electric Company, Schenectady, N. Y., in Bulletin No. 4608, just issued, describes its improved Type H subway transformers as possessing the following essential characteristics: They are absolutely watertight; they are properly proportioned for the limited space available in the manholes; they possess high efficiency and large radiating surfaces, and their temperature rise is small. These transformers are manufactured for a frequency of 60 cycles at standard voltages, and in capacities of from 5 to 300 kw. inclusive. A complete description with illustrations and dimensions is contained in the bulletin.

APPROVED ELECTRICAL SUPPLIES.—The Electrocraft Publishing Company, Detroit, Mich., announces that the third edition of the Electrocraft Illustrated List of Approved Electrical Supplies will shortly be issued and that copies will be sent (free of charge) only to actual buyers, direct or indirect, of electrical supplies. Applications for copies should be made on the letter heads of the applicants and accompanied by 10 cents in stamps or silver to pay postage. It is further announced that the new list will be greatly enlarged and improved and that everything electrical which has been approved by the Underwriters' Laboratories will be fully illustrated and described. It will also contain the National Electrical Code, illustrated and explained.

Business Notes.

FIXTURE STUDIO.—The Central Electric Company, Chicago, announces the formal opening of its fixture studio, which is supplied with every convenience for demonstrating lighting effects.

MR. HARLEY D. CARPENTER has moved from Popular Street to his new store, 192 Mead Avenue, Meadville, Pa., where he will carry a full line of electrical goods. He does a contracting business in Meadville.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, Ill., has recently been appointed agent for the Crescent Insulated Wire & Cable Company, Trenton, N. J. The Metropolitan Company will carry a large stock of this well-known product, thus enabling it to fill orders promptly.

NEW CEILING FAN.—Mr. A. Rosenberg, of the A. Rosenberg Motor & Manufacturing Company, Baltimore, Md., informs us that he will bring out in 1909 a new ceiling fan, under patent issued August 27, 1907. He says: "This will permit any kind of motor being inserted in the same pattern of fan. Any kind of current, alternating or direct, any voltage, or any cycle, can be used. The standard pattern of 12 in. desk fan motor being interchangeable is suited to this fan. The motor when out of order can be removed and replaced without taking down the entire fan. The device takes no more current than any 12 in. desk fan."

THE U. T. HUNGERFORD BRASS & COPPER COMPANY, of 497 Pearl Street, New York, is making a specialty of copper busbar and uses only the highest grade of electrolytically refined copper for this purpose. The requirements of the trade also demand that material of this kind shall be drawn exact to sizes with sharp corners and bright smooth surfaces. The copper bar-mill is equipped with the latest and most efficient mechanical devices for producing material of this kind. The firm carries a large and well assorted stock of rectangular and round copper bars, and from its mill is prepared to furnish at short notice, irregular shapes, such as commutator bars, round edge strips and sawed bars, etc.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUG. 4, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

894,800. POWER TRANSLATING APPARATUS; Joseph Sachs, Hartford, Conn. App. filed July 2, 1904. A transmission system for automobile power wagons making use of an aligned motor and generator having an intervening clutch connection.

894,818. ELECTRODE FOR THE EVOLUTION OF OZONE FROM OXYGEN OR ATMOSPHERIC ACID; John Richardson Craig, Jr., Glasgow, Scotland. App. filed April 6, 1908. Electrode for the evolution of ozone from oxygen or atmospheric air by the silent discharge of a high-tension electric current. Makes use of a chamber having blades with serrated edges between which the discharge takes place.

894,820. TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed May 23, 1907. A system of telegraphy in which a plurality of dots are transmitted by a single key depression. Makes use of relays having weighted armatures adapted to vibrate with a certain periodicity.

894,826. MULTIPLE CLUSTER SOCKET; Charles D. Gervin, New York, N. Y. App. filed July 16, 1907. A cluster lamp socket having a metallic part to which the threaded shells are connected and a central insulating block around which is wrapped a single wire constituting a common central terminal for the lamps.

894,835. INCUBATOR ALARM; Rebecca Johnson, Maxwell, Ia. App. filed Feb. 20, 1907. A thermostatic alarm for incubators making use of a diaphragm air chamber displacing a plunger to close an alarm circuit.

894,836. RECEIVING TELEGRAPHIC AND TELEPHONE IMPULSES SIMULTANEOUSLY; Isidor Kitsee, Philadelphia, Pa. App. filed June 21, 1906. In a line of transmission, a telegraphic receiving device inserted in series thereto, condensers shunting said receiving device, in combination with an inductorium, one coil therefor connected to said condensers and forming part of the shunt around said receiving device, the other coil connected to a telephonic receiver.

894,844. GROUND-WIRE CLAMP; Kempster B. Miller, Chicago, Ill. App. filed July 6, 1907. In a ground wire clamp, a screw plate having four holes therein, and a U-shaped wire passing through two of said holes, substantially as described.

894,866. DRY BATTERY; George M. Wheeler and Henry Wilhelm, Brooklyn, N. Y. App. filed Oct. 12, 1907. In order to dispense with the use of a zinc cup in dry batteries, patentee makes use of a porous sheet, a zinc sheet and an insulating sheet rolled into a tube and inclosed within an exterior casing.

894,878. VARIABLE SPEED TRANSMISSION; Henry H. Cutler, Milwaukee, Wis. App. filed Jan. 5, 1906. A transmission system for motor vehicles making use of a form of planetary gear box having magnetic clutches.

894,886. AUTOMATIC CUT-OFF FOR INDICATING MEANS; Albert B. Herrick, Ridgewood, N. J. App. filed May 21, 1904. In a railroad signal system of the type having a continuously movable band and recording markers, patentee provides a magnet displaced arm to establish contact with different markers of the series.

894,910. AUTOMATIC MAGNETIC CIRCUIT BREAKER; William M. Scott, Philadelphia, Pa. App. filed March 26, 1907. Has a latch operated by a solenoid and a dash-pot plunger latched directly to the core of the solenoid.

894,931. TROLLEY CAR FOR ELECTRIC MOTOR VEHICLES; Riccardo Arno and Luigi Negro, Turin, Italy. App. filed June 14, 1906. Relates to vehicles adapted to run on rails or independently by a trolley connection established through a flexible cable which drags a special trolley along the trolley wire behind the vehicle.

894,944. INDUCTION-CURRENT GENERATOR; Martin Fischer, Zurich, Switzerland. App. filed Nov. 20, 1903. A magnetic inductor comprising in combination a horse-shoe magnet having two pairs of poles, plates connecting the poles, a coil between the poles parallel to the legs of the magnet and having an axial opening therethrough, an armature in said opening, armature extensions on the ends of the armature extending over the ends of the coil, means at the side of the coil to connect the armature extensions, and pivots in said plates taking into said means at points between the ends of the coil.

894,945. MAGNETIC INDUCTOR; Martin Wischer, Zurich, Switzerland. App. filed Sept. 26, 1904. A magnetic inductor having an armature core mounted in the coil in such a manner as to be capable of rotating or oscillating about the axis of the coil, the pole pieces of the armature extending over the ends of the coil and partly along its length.

894,950. DYNAMO ELECTRIC MACHINE; William T. Hensley, Wilkinsburg, Pa. App. filed Oct. 18, 1907. A commutator bar having a semi-annular groove on one side near its upper end, and a neck or strip having a looped extremity that engages said groove.

894,951. COMMUTATOR; William T. Hensley, Wilkinsburg, Pa. App. filed Oct. 18, 1907. Relates to modifications of previous patent.

894,952. RAIL BOND; Albert B. Herrick, Cleveland, Ohio. App. filed Oct. 9, 1907. Covers a rail bond of U-shape built up of copper ribbons inclosed in sheet metal embossed plates at their extremities adapted to be soldered to the rail flange.

894,954. GAS RANGE LIGHTER; Peter A. Johansen, Omaha, Neb. App. filed Dec. 6, 1907. An ignition system for a gas range making use of a gear operated circuit closer controlled by the gas cock.

894,964. ELECTRIC RAILWAY; Joseph Mayer, Rutherford, N. J. App. filed Sept. 13, 1907. A trolley collector for electric locomotives of the type having parallel link motion, making use of an auxiliary hinged section at the top.

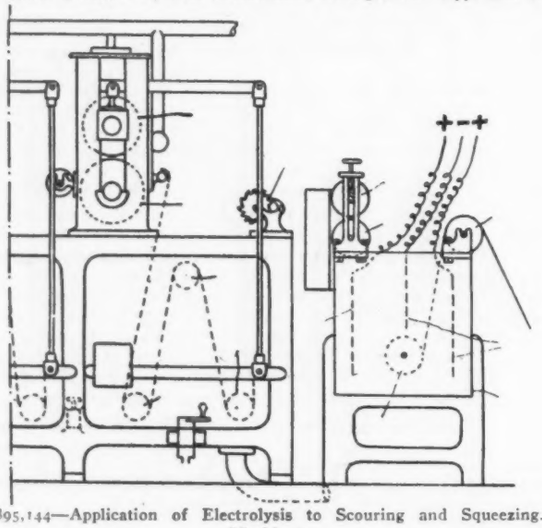
894,979. LOAD EQUALIZER FOR ELECTRIC CIRCUITS; John S. Peck, Manchester, England. App. filed Nov. 15, 1907. In an equalizing system for alternating current circuits, the combination with a rotary converter having two mechanically and electrically connected rotors and independent stator windings, one of which is connected to the circuit to be regulated, of a dynamo-electric machine electrically connected to one of the members of the rotary converter and provided with a flywheel, and an induction motor having its stator winding connected to the rotor windings of the rotary converter.

895,006. MECHANISM FOR RECOVERING, TRANSFORMING AND CONSERVING ENERGY; Léon Dion, Wilkes-Barre, Pa. App. filed May 8, 1906. Patentee provides means to conserve the energy of a water distribution system in a dwelling by having water-driven generators in the pipe connections.

895,012. MOTOR CONTROLLING DEVICE; Fletcher D. Hallock, Wilkinsburg, Pa. App. filed Nov. 8, 1907. Speed regulating device for an electric motor having means employed in connection with any well-known standard form of starting rheostat for insuring substantially maximum field strength of the motor when starting the same.

895,035. ELECTRIC RAILROAD SIGNAL; Arthur Wellington McMaugh and Robert Welch, St. Catherines, Ont., Can. App. filed Dec. 3, 1906. A railroad signal system including detail features of a special collector shoe depending beneath the car and adapted to engage a continuous third-rail between the track rails.

895,044. METHOD AND APPARATUS FOR CONTROLLING ELECTRIC CIRCUITS; Otto Rothenstein, Chicago, Ill. App. filed Nov. 1, 1906. The method of controlling electric circuits by directing a stream of mercury through an inert insulating liquid, such as alcohol, toward another fixed terminal for the purpose of closing the circuit, and suppressing said stream of conducting liquid altogether, for the purpose of interrupting the circuit.



895,144—Application of Electrolysis to Scouring and Squeezing Machines.

895,070. TROLLEY POLE MOUNT; Edwin H. Burnes, Amsterdam, N. Y. App. filed July 27, 1904. The trolley pole is hinged on a swiveled base and is maintained upright by link connections with bow-springs on the base.

895,100. ALTERNATING CURRENT METER; Emanuel Morck, Charlottenburg, Germany. App. filed Dec. 5, 1903. An alternating current meter of the Ferraris principle whereby a shifting of phase of 90 deg. may be produced.

895,112. UNGUMMING RAW SILK; Peter Schmid, Basel, Switzerland. App. filed July 6, 1907. Means for ungumming raw silk which consists in treating the soap solution with an electric current.

895,135. CONTROLLING SYSTEM FOR LIFTING MAGNETS; Reuben I. Wright, Cleveland, Ohio. App. filed April 10, 1908. Has an electric motor and a lifting magnet winding in shunt therewith and means for automatically putting resistance in series with said winding.

895,144. APPLICATION OF ELECTROLYSIS TO SCOURING AND SQUEEZING MACHINES; Jean M. J. Baudot, Roubaix, France. App. filed March 28, 1905. The process of washing fabrics free of soap, etc., which consists in guiding the fabric through a trough containing a solution of alkaline carbonate and a pair of electrodes, the cloth traversing a path between said electrodes whereby the current traverses the cloth, and finally squeezing the fabric to expel the electrolytic products therefrom.

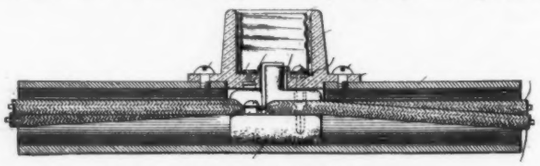
895,159. METHOD OF PRODUCING AMALGAMS OR ALLOYS; Courtland F. Carrier, Jr., Elmira, N. Y. App. filed Jan. 11, 1907. A method of producing amalgams which consists in passing an electric current to a plurality of independent bodies of fluid metal beneath a common electrolyte and supplying the fluid metal to each of said bodies.

895,163. ELECTRODEPOSITION OF COPPER; Sherard Osborn Cowper-Coles, London, England. App. filed May 20, 1907. The process of electrodeposition of copper, which consists in passing a current of electricity of a density of 200 amp per square foot of cathode surface from an anode to a cathode and revolving said cathode of a speed of 1500 or more revolutions per minute in an electrolyte consisting in a predetermined electrolyte.

895,164. MANUFACTURE OF CARTRIDGE CASES AND SIMILAR ARTICLES; Sherard Osborn Cowper-Coles, London, England. App. filed May 20, 1907. The process for producing cylindrical articles closed at one end, which consists in immersing a mandrel in an electrolyte, electrolytically depositing a suitable metal upon the exterior of lateral portions and one end of the mandrel and rotating the mandrel at high speed during the electrodeposition, and removing the deposited metal in integral form from the mandrel.

895,171. CABLE HANGER; John D. E. Duncan, East Orange, N. J. App. filed Nov. 29, 1907. Makes use of a petticoated insulator having a pin depending from the interior insulator and headed therein so as to be firmly engaged by the cement filling.

895,175. APPLIANCE FOR WIRING CONDUITS; Philip H. Fielding, New York, N. Y. App. filed June 6, 1906. A lamp receptacle for conduit wiring designed to be applied directly to the conduit pipe without the use of an outlet box. Patentee cuts a rectangular section from the pipe and applies a two-part receptacle thereto, one part entering the pipe and the other part closing over the first to inclose the bared portion of the circuit wires in a vitreous housing.



895,175—Appliance for Wiring Conduits.

895,196. PROCESS OF TREATING ORE; James Henry Reid, Cornwell, Ontario, Canada. App. filed April 1, 1908. A process for treating ore which consists in passing the ore in a continuous stream through a number of electric arcs producing different temperatures, independently and separately withdrawing the volatile products freed at each arc and independently treating the different volatile products after withdrawal.

895,242. ELECTROMECHANICAL MOVEMENT; George Howlett Davis, West Orange, N. J. App. filed July 11, 1907. A piano player having a continuously rotating drum and levers depressed into engagement therewith by electromagnets so as to have their movement completed by their engagement with the drum.

895,251. TROLLEY CATCHER; George Gessert, Edwardsville, Ill. App. filed March 16, 1908. Has a pair of dome-shaped rollers spring impelled together above the trolley wheel so as to close over the trolley wheel and yield apart in passing hangers, etc.

895,314. AUTOMATIC COLLAPSING AND RE-ERECTING TROLLEY POLE; George Samuel Thomson, Dunedin, New Zealand. App. filed Nov. 29, 1907. A trolley pole having a supporting link which drops to allow the pole to fall by reason of an undue upward movement thereof.

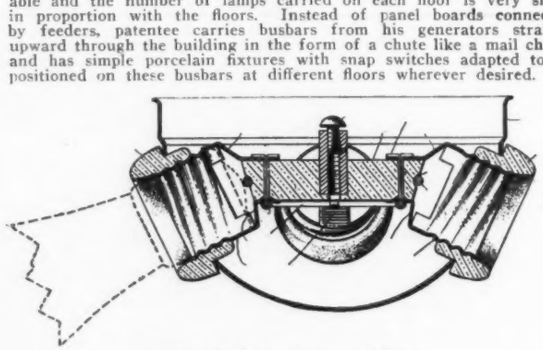
895,321. TROLLEY GUARD; Charles H. Yarrington, Waterbury, Conn. App. filed Dec. 17, 1907. Patentee has a pair of pivoted arms on the trolley hanger which are spring impelled to project upward, but yield in either direction in passing hangers.

895,339. TROLLEY; Leon W. Campbell, Woonsocket, R. I. App. filed Jan. 4, 1907. The trolley wheel has a ball-bearing support of the Hesbright type.

895,345. ELECTRIC SWITCH; James T. Cooper, Cassville, Mo. App. filed July 23, 1907. A pole switch for high potential circuits having a long lever arm which can be pulled upward to interrupt the circuit by a cord.

895,350. MULTIPLEX TELEGRAPH SYSTEM; Amor W. Douglas, Albuquerque, N. Mex. App. filed April 13, 1907. A multiple telegraph system in which sending and receiving signaling apparatus responsive to alternating currents are employed in connection with a simple Morse system.

895,362. WIRING CONSTRUCTION FOR BUILDINGS; Adolph L. Goldschmidt, New York, N. Y. App. filed Feb. 5, 1907. A wiring construction for tall steel frame buildings where floor space is valuable and the number of lamps carried on each floor is very small in proportion with the floors. Instead of panel boards connected by feeders, patentee carries busbars from his generators straight upward through the building in the form of a chute like a mail chute, and has simple porcelain fixtures with snap switches adapted to be positioned on these busbars at different floors wherever desired.



894,826—Multiple Cluster Socket.

895,378. REVERSIBLE AND COLLAPSIBLE TROLLEY-POLE FOR ELECTRIC VEHICLES; John Lindsay and Robert Lindsay, Dunedin, New Zealand. App. filed Nov. 6, 1907. The trolley pole is adapted to be reversed without breaking the contact with the cable and is collapsible to drop in case the wheel leaves the wire. Has two jointed sections both pivoted to swing in the vertical plane of the wire and manipulated by cords and springs in the reversing and retrieving movements.

895,400. MOTOR CONTROL SYSTEM; Charles D. Gilpin, Cleveland, Ohio. App. filed April 10, 1908. A control system for hoisting apparatus particularly for use with coal handling bridges where the weight does not overhaul the motors and it is not always desirable to provide a full reversing controller.

895,405. APPARATUS FOR OXIDIZING FLOUR; William Lester Jones, Stockholm, Cal. App. filed Jan. 2, 1906. Flour is impelled through a chamber by a fan in which it is exposed to the action of ozone or nascent oxygen produced by short-circuiting dry batteries in the chamber, this method being used to prevent explosion of the inflammable material.